RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE - PHASE 2

SUCF No. 161062

Project Manual & Specifications

May 9, 2025

Owner

Cornell University
Ithaca, New York 14853

Architect

Architectural Resources, D.P.C.
505 Franklin Street
Buffalo, New York 14202

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INSTRUCTIONS TO BIDDERS

Project: Renovate Livestock Pavilion for Surge Space – Phase 2

Owner: The State University of New York, by
Cornell University for and on behalf of
the College of Agriculture and Life Sciences
Ithaca, New York 14853

Architect: Architectural Resources
505 Franklin Street
Buffalo, New York 14202

1. PROPOSAL FORMS

a. Proposals shall be made only on the forms provided and all blank and underlined spaces in the forms shall be fully filled in, in ink or typed; amount shall be fully stated both in writing and in figures. Proposals shall be signed by Principals or Officers duly authorized to execute such documents on behalf of their respective firms or organizations, and the Certificate included in the Bid Form shall be completed accordingly. Bidder's legal name must be fully stated. Completed form shall be without interlineations, alterations, or erasures unless initialed and dated by the signer.

2. RECAPITULATION OR PROPOSAL

a. Proposals shall not contain any recapitulation of the work to be done. No oral, telegraphic or telephonic proposals or modifications will be considered.

3. METHOD OF SUBMISSION

a. Proposals shall be prepared and enclosed in a sealed envelope. **The Contractor shall submit one original signed Bid Form.** Envelope shall be addressed to:

Brenda Frank, Manager
Facilities Contracts
121 Humphreys Service Building
Cornell University
Ithaca, New York 14853

Proposal for: Renovate Livestock Pavilion for Surge Space – Phase 2

Submitted by: _____
(Bidder)

b. Proposals shall be delivered to the Owner at the address listed above not later than **2:00PM on July 2, 2025**.

4. BID OPENING

a. Proposals will be opened and read aloud publicly by the Owner in Room 101, Humphreys Service Building, Cornell University Campus, Ithaca, New York and via Zoom at https://cornell.zoom.us/j/98516188170?pwd=1RlbQFYaBGzGQoIztopGZxswV9YlLD.1&from=addon, at the hour and date listed in 3b. The Owner reserves the right to postpone the date and time of opening of proposals at any time prior to the date and time announced in this Instruction to Bidders or amendments thereto.

5. BIDDING DOCUMENTS

a. The Bidding Documents will consist of the following:

(1) Instructions to Bidders.

(2) Bid Form.

(3) General Conditions of the Contract and Division 1 - "General Requirements".

(4) Drawings and Specifications.

(5) Addenda and/or bulletins issued prior to date of opening of Proposals.

6. DRAWINGS AND SPECIFICATIONS FURNISHED

a. Contract Documents may be obtained from Facilities Contracts website (https://fcs.cornell.edu/projects-out-to-bid). For assistance call 607-255-5343.

b. Sets will be available at $49.00 per set without refund. No partial sets will be issued. The Contract Documents remain the property of the Owner. Fees are waived for certified Minority and Women Owned and Service Disabled Veteran Owned Businesses. Certification status will be verified in the New York State Contract System.

7. START OF WORK

a. Work shall begin upon Owner’s written authorization to proceed and shall be completed within four hundred ten (410) calendar days from the contract approval date provided in the authorization to proceed.

b. The construction schedule is critical. The Contract shall include for adequate manpower and equipment in his Bid to ensure that no slippage of the schedule will occur.

8. BONDS

a. Performance and Payment Bonds. The successful Bidder shall furnish the Owner with "Performance" and “Labor and Material Payment Bonds", each in the amount of 100% of the Contract Price. The cost of such bonds shall be included in the Bidders Proposal. Each of these Bonds are to be in a form with such sureties as the Owner may approve.

b. Bid Security. Each Bidder will be required to furnish a Bid Security in the amount of 10% of the Bid Amount. Bid Securities may be in the form of a Bid Bond or Certified Check. Such Bid Security shall guarantee that the Bidder will execute the Contract if it is awarded to him in conformity with his Proposal. Such Proposal Guarantee Bond shall include a statement that the Insurer shall, at the option of the Bidder, be willing to provide to the Bidder the Contract Bonds as described in 8a above.

9. AWARD OF CONTRACT

a. It is the intent of the Owner to enter into a Contract with one General Contractor for the entire project. All labor and services and materials and supplies, etc. are to be furnished in accordance with the Contract.

b. Award of the Contract shall be made to the bidder submitting the lowest responsive and responsible bid who, in the opinion of the Owner, is qualified to perform the work. The Owner shall determine the lowest bid by adding to or deducting from the Base Bid of the bidders additive or deductive alternates, if any, the Owner elects to accept after the opening of the Bids. Alternates will be accepted in the order they are set forth in the Bid Form. The unit prices set forth in the Bid for additions to or deductions from the work shall not be considered in determining the lowest bid.

c. The Owner reserves the right to reject any or all Proposals, and to waive any informalities in Bidding.

d. All Proposals shall remain in force and effect for a period of not less than ninety (90) calendar days following the bid opening date.

e. Contract award shall be subject to approval of Cornell University's Contractors Qualification Statement.

10. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

a. Each Bidder shall visit the Site of the proposed work, fully acquaint and familiarize himself with the conditions as they exist and the character of the operations to be carried on under the proposed Contract, and make such investigation as he may see fit so that he shall fully understand the facilities, physical conditions and restrictions attending the work under the Contract.

b. Each Bidder shall also thoroughly examine and become familiar with the Drawings, Specifications and associated Bid Documents.

c. By submitting a Proposal, the Bidder covenants and affirms that he has carefully examined the Drawings, Specifications, associated Bid Documents, the Addenda and Bulletins, if any, and the Site, that he relies on no representation by the Owner, and that from his own investigation he has satisfied himself as to the nature and location of the work, the general and local conditions, and all matters which may in any way affect the work or its performance, and that as a result of such examination and investigation, he fully understands the conditions of bidding and that he will not make any claim for, and waives any right to damage because of misinterpretation or misunderstanding of the Bid Documents and the conditions of bidding.

11. DISCREPANCIES

a. Should a Bidder find discrepancies in or omissions from the Drawings, Specifications and associated Bid Documents, or should he be in doubt as to their meaning, he shall at once notify the Architect, who will send written instructions to all bidders. Neither the Owner nor the Architect will be responsible for oral instructions. Every request for such interpretation should be in writing, addressed to the Architect. Inquiries received seven (7) or more days prior to date fixed for opening of Bids will be given consideration.

12. PRE-BID CONFERENCE

a. A pre-bid conference has been scheduled for 10:00AM, June 11, 2025, in Room 102C of Humphreys Service Building or via Zoom at:

https://cornell.zoom.us/j/95101923030?pwd=6OoIbLy2ONmza1m7P1plWcytFcscwK.1&from=addon

A pre-bid walkthrough will follow and will meet at the Livestock Pavilion, 48 Judd Falls Road in Ithaca, New York.

The Pre-Bid Conference is designed to assist Bidders in understanding the Contract Documents, the opportunity to pose clarifying questions or make inquiries regarding Contract Documents. Results will be published in an Addendum.

b. NOTE: All Contractors/Subcontractors attending the walkthrough are REQUIRED to sign a Release if using Cornell equipment. You are also required to have appropriate PPE including, but not limited to, all current OSHA regulations and at a minimum the use of eye protection foot protection, hand protection, head protection, hearing protection and fall protection. Additionally, the Borrower shall provide their own five-point safety harness where required.

13. ASSUMPTION OF RISK

Consultants/Subconsultants are expected to bring to jobsite all applicable personal safety devices required or needed to view the Scope of Work. Use of Cornell equipment or tools, with or without permission, involves inherent risk of injury to User(s). Any use of Cornell equipment is conditioned upon the assumption of all risks attendant to the use of any tools or equipment – including personal injury, death or permanent disability – arising from the Use of Cornell equipment or tools. These risks also include but are not limited to: accidents, collisions, falling, as well as unforeseen risks resulting in injuries to User and/or bystanders. Participation in a walk-through or similar activity constitutes acceptance of risk assumption.

14. TRADE SUBCONTRACTORS, MATERIAL SUPPLIERS

a. Each portion of the work shall be performed by an organization equipped and experienced to do work in that particular field, and no portion of the work shall be reserved by the Bidder to himself unless he is so equipped and experienced. Subcontracts shall be awarded only to parties satisfactory to the Owner and the Architect. Each subcontractor and materials supplier shall be approved individually.

b. In the spaces provided in the Bid Form, the Bidder will list all portions of the work they propose to perform directly with their own forces.

c. A list of names from which the Bidder proposes to select subcontractors, materials suppliers, and/or manufacturers for the principal trades or subdivisions of the work should be entered for each Section, Subdivision, or Supplier listed in the Bid Form.

d. In the Bid Form, there has been listed the principal trades or subdivisions of the work for which such a listing is required, together with the provisions which govern the listing, selection, and approval of principal subcontractors.

15. ALTERNATE PROPOSALS

a. Certain Alternate Proposals may be requested. They will be listed in the Bid Form and all Bidders are required to bid on all Alternates without exception, in the spaces provided.

b. Alternate Proposals shall include all overhead, profit, and other expenses in connection therewith.

c. Alternate Proposals, if accepted, will be accepted in the order in which they are set forth in the Bid Form.

16. UNIT PRICES

a. Certain Unit Prices may be requested. They will be listed in the Bid Form and all Bidders are required to bid on all Unit Prices without exception, in the spaces provided.

b. Unit Prices shall include all overhead, profit, and other expenses in connection therewith.

17. SCHEDULE OF VALUES

a. A partial "Schedule of Values" for certain trades and/or subdivisions of the work is required as part of the Bidder's Proposal in the Bid Form.

b. The successful Bidder shall submit a complete "Schedule of Values" showing the amounts allocated to the various trades, suppliers, subcontractors, installers and General Contractor's work, aggregating the total sum of the Contract. If requested by the Owner or Architect, the complete "Schedule of Values" shall be submitted prior to award of Contract.

18. ADDENDA AND BULLETINS

a. Addenda and/or bulletins issued during the bidding period shall be acknowledged in the space provided in the Bid Form.

19. SUBSTITUTIONS

a. Proposals shall conform to the requirements of the Bid Documents.

b. The Bidder may offer substitutions for any item of material or equipment, element of work, or method of construction set forth in the Bid Documents, with the exception of Form of Contract, General Conditions and General Requirements - Division 1, by listing the proposed substitutions and the amounts to be deducted from the Base Bid corresponding to each such proposed substitution in the spaces provided in the Bid Form. However, the Bidder is cautioned to make his base proposal on the materials and items specified by name or other particular reference.

20. SUB-SURFACE CONDITIONS

a. Boring information, water levels, indications of sub-surface conditions and similar information given on the Drawings or in the Specifications are furnished only for the convenience of the Bidders. The Owner, Architect and Consulting Engineer make no representation regarding the character and extent of the soil data or other sub-surface conditions to be encountered during the work and no guarantee as to the accuracy or validity of interpretation of such data or conditions is made or intended.

b. Each Bidder shall, by careful examination, inform himself as to the nature and location of the work, the conformation of the ground, subsoil and ground water conditions, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. The Bidder may, at his option, conduct tests at his expense, including borings, by prior notification to the Owner. Each Bidder shall make his own deductions of sub-surface conditions which may affect methods or cost of construction of the work hereunder and he agrees that, if awarded the construction contract, he will make no claim for damages or other compensation, except such as are provided for in the Contract Documents, should he encounter conditions during the progress of the work different from those as calculated and/or anticipated by him.

21. SALES AND USE TAX EXEMPTION

a. The Owner a non-profit educational institution, is exempt from payment of certain Sales and Use Taxes.

22. FEDERAL EXCISE TAX

a. The Owner a non-profit educational institution, is exempt from payment of certain Federal Excise Taxes.

23. TAX EXEMPT STATUS

a. Bidders shall inform all prospective subcontractors and suppliers from whom they expect to obtain proposals or quotations of the tax-exempt status of the Owner as set forth above and request that they reflect anticipated tax credits in their proposals or quotations.

24. EXEMPTION CERTIFICATES

a. At the Contractor's request, following the award of a Contract, Contractor exempt purchase certificates will be furnished by the Owner to the Contractor with respect to such tax-exempt articles or transactions as may be applicable under the Contract.

25. REQUIRED SUBMISSIONS

a. Provide with Bid Proposal:

(1) Acknowledgement of Addenda and/or Bulletins issued prior to bid opening
(2) Certificate as to Corporate Bidder
(3) List of Proposed Subcontractors
(4) Schedule of Values
(5) Alternate Proposals and Unit Prices
(6) Completion of Milestone Schedule
(7) Bid Security

b. **Within three (3) business days after bid opening (see attached forms)**:

1. MWBE and SDVOB Utilization Plan Form
2. EEO Policy Statement
3. Six-Month Workforce Projection
4. NYSDOL Contractor Certificate of Registration
5. Vendor Responsibility Questionnaire
6. Procurement Lobbying Act SFL J&K Forms
7. Omnibus Procurement Act Forms I and II (if bid is over One Million Dollars)
8. Offeror's Certification Regarding Sexual Harassment Prevention Policies Pursuant to the State Finance Law §139-I
9. NY Human Rights Law Executive Order 177 Certification

c. Execution of Contract:

1. Insurance Certificate
2. Performance Bond
3. Labor and Material Payment Bond
4. NYSDOL Contractor Certificate of Registration for Subcontractors
5. Schedule of Work
6. Federal Tax Identification Number

END OF SECTION

RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE – PHASE 2

Cornell University, Ithaca, New York

BID FORM

Submitted by: _____ Date _____

To: Brenda Frank, Manager
Facilities Contracts
121 Humphreys Service Building
Cornell University
Ithaca, New York 14853

Gentlemen:

The undersigned, _____
(Name of Bidder)

a _____
(Type of Firm, State of Incorporation, if applicable)

of _____
(Address)

having carefully examined the Instructions to Bidders, the "Conditions of the Contract" (General, Division 1 - "General Requirements"), and the Drawings, Specifications and associated Bid Documents dated May 9, 2025, prepared by Architectural Resources, D.P.C., 505 Franklin Street, Buffalo New York, 14202, as well as the premises and conditions affecting the work, proposes to furnish all material, equipment, labor, plant, machinery, tools, supplies, services, applicable taxes and specified insurance necessary to perform the entire work, as set forth in, and in accordance with the said documents for the following considerations:

1. BASE BID

a. All work complete, for the sum of

_____ ($ _____)
for MATERIALS, SUPPLIES, LABOR, and
SERVICES AND ALL OTHER COSTS.

2. ALTERNATE PROPOSAL

a. The undersigned, if awarded the Contract, proposes to perform work in addition to or in place of the scope of the work shown and specified herein as associated with the Base Bid in accordance with the following Alternate Proposals, which amounts are to be added or deducted to the amount of the Base Bid as indicated for the Alternates specified in Division 1 of the Specifications.

b. If the Bidder desires to indicate that the acceptance of any Alternate or Alternates will result neither in an addition to nor a deduction from the value of the work, he shall enter the phrase "No Change" in response to such Alternate or Alternates.

c. It is understood that the Owner will accept or reject Alternate Proposals in conjunction with the award of a construction contract and that Alternates will be accepted in the order provided below.

Alternate No.	Description	ADD	DEDUCT
NONE		$ _____	$ _____

3. MINORITY AND WOMEN'S BUSINESS ENTERPRISES (M/WBEs)

a. The undersigned shall, if awarded the Contract, endeavor to include both Minority and Women Owned Business Enterprises participation and to demonstrate a "good faith effort" with respect to these requirements. Goals shall be as follows:

- A goal of 4.30% for Minority-Owned Business Enterprise (MBE) participation shall be applied as follows: a maximum of one-third (1/3) of the goal may be applied to purchases of materials, supplies, and equipment from MBEs.

- A goal of 3.34% for Women-Owned Business Enterprise (WBE) participation shall be applied as follows: a maximum of one-third (1/3) of the goal may be applied to purchases of materials, supplies, and equipment from WBEs.

- A goal of 6.00% for Service Disabled Veteran Owned Businesses ("SDVOB") participation shall be applied as follows: a maximum of one-third (1/3) of the goal may be applied to purchases of materials, supplies, and equipment from SDVOBs.

4. START OF WORK AND TIME FOR COMPLETION

a. Work at the site shall not start prior to receipt of the Owner's written Notice to Proceed and be completed within four hundred ten (410) calendar days from that date.

b. The construction schedule is critical. The Contract shall include for adequate manpower and equipment in his Bid to ensure that no slippage of the schedule will occur.

5. LIST OF PROPOSED PRINCIPAL SUBCONTRACTORS

a. The undersigned agrees, if awarded the Contract, to employ subcontractors from the following list for the Sections or Subdivisions of work stated below subject to the following provisions:

(1) Prior to the award of the Contract, the Owner and Architect reserve the right to review the list of "Proposed Principal Subcontractors", and to delete from it the name or names of any to whom they may have a reasonable objection. The Contractor may make the final selection of principal subcontractors at his option from the resulting list after the award of the Contract.

b. Bidder shall list the names of at least one subcontractor for each Section or Subdivision of the work listed below and shall limit the listing for each such Section or Subdivision to THREE (3) names.

c. If Bidder does not propose to employ a Subcontractor for any Section or Subdivision of the work listed below, he shall enter the name of his firm for each such Section or Subdivision.

d. All Subcontractors must provide a NYSDOL Contractor Certificate of Registration.

MASONRY

_____ _____

_____ _____

HVAC

_____ _____

_____ _____

ELECTRICAL

_____ _____

_____ _____

EARTHWORK

CONCRETE

CARPENTRY

FIRE SUPPRESSION

COMMUNICATIONS

UTILITIES

6. PRINCIPAL SUBDIVISIONS OR ELEMENTS OF THE WORK TO BE PERFORMED BY GENERAL CONTRACTOR'S FORCES

a. If awarded a Contract, we will perform the following portions of the Work with forces directly employed by the undersigned:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

b. If awarded a Contract, the Contractor's main **Project Manager** will be:

_____

(include resume with bid)

The Owner reserves the right to reject the names of any to whom they have a reasonable objection.

c. If awarded a Contract, the Contractor's main **Superintendent** will be:

_____

(include resume with bid)

The Owner reserves the right to reject the names of any to whom they have a reasonable objection.

7. TIME PROGRESS SCHEDULE

a. The undersigned agrees, if awarded the Contract, to furnish a "Time Progress Schedule" showing the starting and completion dates for all principal trades and subdivisions of the Work, together with such additional information related thereto as may reasonably be required.

8. BONDS

a. Performance and Payment Bonds. The undersigned agrees, if awarded the Contract to execute and deliver to the Owner "Performance" and "Labor and Material Payment Bonds" in such form as acceptable to the Owner and in an amount equal to 100% of the Contract Sum. Such bonds will be furnished by

_____

(Name of Surety)

b. Bonding Rate for Change Orders. _____%

c. Bid Bond. A Bid Bond in the amount of $_____ (10% of Bid Amount) is attached to this Bid.

9. SCHEDULE OF VALUES

a. The undersigned agrees, prior to the award of a construction contract and upon the request of the Architect or Owner, to submit a complete, itemized and detailed "Schedule of Values" including Alternates elected, if any, showing the amount allocated to the various trades and subdivisions of the work, aggregating the total Contract Sum.

b. To facilitate the evaluation of Bids, the undersigned has included in each part of his Bid the following values for the trades and/or subdivisions of the work as listed below. Values for work included under Alternate Proposals are excluded. Values relative to General Contractor's costs for General Conditions are excluded.

Spec Section	Trades and/or Subdivision	Value Included in Base Bid
Division 01	General Requirements	
Division 02	Existing Conditions	
Division 03	Concrete	
Division 04	Masonry	
Division 05	Metals	
Division 06	Wood, Plastics & Composites	
Division 07	Thermal and Moisture Protection	
Division 08	Openings	
Division 09	Finishes	
Division 10	Specialties	
Division 11	Equipment	
Division 12	Furnishings	
Division 21	Fire Suppression	
Division 22	Plumbing	
Division 23	Heating, Ventilation, And Air Conditioning	
Division 26	Electrical	
Division 27	Communications	
Division 28	Electronic Safety and Security	
Division 31	Earthwork	
Division 32	Exterior Improvements	
Division 33	Utilities	
	Field Order Allowance No. 1	550,000

Total Bid $_____

10. SUBSTITUTIONS

a. The Base Bid is predicated on compliance with the Drawings and Specifications without substitutions.

b. The Bidder may offer substitutions for any item noted in the Specifications, with the exception of Form of Contract, General Conditions and General Requirements - Division 1, by listing in the space below the proposed substitution, together with the amount to be deducted from the Base Bid if the substitution is accepted.

c. The Owner reserves the right to accept or reject any proposed substitution.

d. The Bidder may offer a substitution for General Conditions, Article 2.05, Superintendence by Contractor, by listing in the space below the proposed percentage of supervision to be provided onsite, together with the amount to be deducted from the Base Bid if the substitution is accepted.

Percentage of Supervision _____ %

Deduction from Base Bid $(_____)

e. The sum stated includes any modifications of work or additional work that may be required by reason of acceptance of substitution. Substitute materials must be approved and accepted by the Owner in writing before same may be used in lieu of those named in the Specifications.

Item and Description of Substitution	Specification Reference Section & Page No.	Deduction from Base Bid Labor	Material

11. ACCEPTANCE

a. The undersigned agrees that this Proposal shall remain in force and effect for a period of not less than ninety (90) calendar days following the Proposal opening or such other time as may be agreed to by the Owner and Contractor.

b. If written notice of acceptance of this Proposal is mailed, telegraphed or delivered to the undersigned within sixty (60) calendar days after the date of opening of Bids, or any time thereafter before this Proposal is withdrawn, the undersigned will within ten (10) calendar days after the date of such mailing, telegraphing or delivery of such notice, execute an Agreement between Contractor and Owner, amended and/or supplemented, if required, in accordance with the Proposal as accepted.

c. The undersigned further agrees, if requested by the Owner, to furnish Performance and Payment Bonds pursuant to Article 7 herein within ten (10) calendar days of issuance of such notice.

d. It is understood and agreed that award of the Contract shall be made to the bidder submitting the lowest responsive and responsible bid who, in the opinion of the Owner, is qualified to perform the work. The Owner shall determine the lowest bid by adding to or deducting from the Base Bid of the bidders additive or deductive alternates, if any, the Owner elects to accept after the opening of the Bids. Alternates will be accepted in the order they are set forth in the Bid Form. The unit prices set forth in the Bid for additions to or deductions from the work shall not be considered in determining the lowest bid.

e. It is understood and agreed that the Owner reserves the right to reject any or all proposals, to waive any informalities in bidding, and to hold all proposals for the above noted period of time.

f. The undersigned, if awarded a contract, agrees to complete and return a Vendor Responsibility form with their executed Agreement.

12. UNIT PRICE SCHEDULE

a. The undersigned agrees, if awarded the Contract, to perform work "In addition to" or "deducted from" the scope of the Contract Documents as directed by the Owner and/or Architect, computed in accordance with the unit prices hereinafter listed, which prices include all overhead, profit and other expense items in connection therewith, subject to the terms of the Contract Documents.

b. All unit prices include the installation or omission, complete for each item, together with all work in connection therewith and shall include all shoring, bracing, dewatering and other incidental work.

c. Unit prices shall be the total compensation for the item and includes all overhead, profit and any other charges of the Contractor and/or subcontractor in connection therewith.

d. Adjustments will be computed on net variation of total quantities of like items.

13. ADDENDUM RECEIPT

a. Receipt of the following addenda to the Terms and Conditions, Drawings or Specifications is acknowledged:

Addendum No.	_____	Dated:	_____
Addendum No.	_____	Dated:	_____
Addendum No.	_____	Dated:	_____
Addendum No.	_____	Dated:	_____
Addendum No.	_____	Dated:	_____

14. The undersigned agrees, if they are the low bidder, to furnish withing three (3) business days the following:

1 MWBE and SDVOB Utilization Plan Form
2 EEO Policy Statement
3 Six-Month Workforce Projection
4 NYSDOL Contractor Certificate of Registration
5 Vendor Responsibility Questionnaire
6 Procurement Lobbying Act SFL J&K Forms
7 Omnibus Procurement Act Forms I and II (if bid is over One Million Dollars)
8 Offerer's Certification Regarding Sexual Harassment Prevention Policies Pursuant to the State Finance Law §139-I
9 NY Human Rights Law Executive Order 177 Certification
10 New York State Finance Law 139-L Certification

_____
(Bidder)

By: _____

Title: _____

Business Address: _____

Dated: _____

CERTIFICATE OF NON-COLLUSION

By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his knowledge and belief:

a. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.

b. Unless required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or with any competitor.

c. No attempt has been made or will be made by the bidder to induce any other persons, partnership, or corporation to submit or not submit a bid for the purpose of restricting competition.

_____
(Bidder)

By: _____

Title: _____

Dated: _____

CERTIFICATE AS TO CORPORATE BIDDER

I, _____, certify that I am the _____ of the Corporation named as Bidder within this Bid Form for General Contractors; that _____, who signed said Bid Form on behalf of the bidder was then _____ of said Corporation; that I know his signature; that his signature thereto is genuine and that said Bid Form and attachments thereto were duly signed, sealed and executed for and in behalf of said Corporation by authority of its governing body.

_____
(Secretary-Clerk)

(CORPORATE SEAL)

Dated: _____

G E N E R A L C O N D I T I O N S

FOR

RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE – PHASE 2

CORNELL UNIVERSITY
ITHACA, NEW YORK

GENERAL CONDITIONS

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F		Stored Materials Invoicing Documentation
G		Contractor Performance Evaluation
H		Schedule A – Provisions Required to be Inserted by Law
I		Vendor Responsibility Questionnaire

ARTICLE 1 -- INTERPRETATION OF CONTRACT DOCUMENTS

Section 1.01 - Owner

A. The Owner is Cornell University as identified in the Agreement and referred to throughout the Contract Documents as the "Owner" or "Cornell University".

B. Ownership of Documents: All drawings, specifications, computations, sketches, test data, survey results, photographs, renderings and other material relating to the Work, whether furnished to or prepared by the Contractor, are the property of Cornell University. The Contractor shall use such materials or information therefrom only in connection with the Work of this Contract. When requested, the Contractor shall deliver such materials to Cornell University.

C. The Owner shall give all orders and directions contemplated under the Contract relative to the execution of the Work. The Owner shall determine the amount, quality, acceptability, and fitness of the Work and shall decide all questions which may arise in relation to said Work. The Owner's estimates and decisions shall be final except as otherwise expressly provided.

D. Any differences or conflicts concerning performance which may arise between the Contractor and other Contractors performing Work for the Owner shall be adjusted and determined by the Owner.

E. The table of contents, titles, captions, headings, running headlines, and marginal notes contained herein and in said documents is intended to facilitate reference to various provisions of the Contract Documents and in no way affect the interpretation of the provisions to which they refer.

Section 1.02 - Meaning and Intent of Specifications, Plans and Drawings

The meaning and intent of all specifications, plans and drawings shall be determined in a manner approved by the Owner.

Section 1.03 - Order of Precedence

A. Should a conflict occur in or between or among any parts of the Contract Documents that are entitled to equal preference, the more expensive way of doing the Work, the better quality or greater quantity of material shall govern, unless the Owner otherwise so directs in writing.

B. Drawings and specifications are reciprocal. Anything shown on the plans and not mentioned in the specifications, or mentioned in the specifications and not shown on the plans, shall have the same effect as if shown or mentioned in both.

C. Requirements of reference standards form a part of these specifications to the extent indicated by the reference thereto. When provisions of reference standards conflict with provisions in these specifications, the specifications shall govern.

ARTICLE 2 -- CONTRACTOR

Section 2.01 - Contractor's Obligations

A. The Contractor shall, in good workmanlike manner, perform all the Work required by the Contract within the time specified in the Contract. The Contractor shall comply with all terms of the Contract, and shall do, carry on, and complete the entire Work to the satisfaction of the Owner.

1. All labor for this project shall be paid in accordance with the New York State Department of Labor Prevailing Rate Case No. 2025006392 dated May 28, 2025. The Contractor must provide a copy of the wage schedule to each subcontractor.

2. The Contractor shall post the appropriate prevailing wage schedules in a conspicuous place at the construction site.

3. The Contractor is required to submit a certified copy of its payrolls with each application for payment but not later than 30 days after issuance of its first payroll. Payrolls shall be attached to the designed secured data field in the electronic project management system Payment Application. The certified payroll records must show the employees name, address, and last 4 digits of their SS# as well as hours and days worked by each worker. Certified payroll must also show the occupation at which they worked, the hourly wage paid, and the supplements paid or provided.

B. The Contractor shall furnish, erect, maintain, and remove such construction plant and such temporary Work as may be required.

C. The Contractor shall provide and pay for all labor, material, tools, equipment, machinery, as well as utility connections, transportation, and all other facilities and services necessary for the proper execution and completion of the Work, except as otherwise specified elsewhere in the Contract Documents.

D. Whenever a provision of the Specifications conflicts with agreements or regulations in force among members of trade associations, unions, or councils which regulate or distinguish what work shall or shall not be included in the work of a particular trade, the Contractor shall make all necessary arrangements to reconcile such conflict without delay, damage, or cost to the Owner and without recourse to the Architect or the Owner. In case progress of the Work is affected by undue delay in furnishing or installing items of material or equipment required under the Contract because of a conflict involving such agreement or regulations, the Owner or the Architect may require that other material or equipment of equal kind and quality be provided at no additional cost to the Owner.

Section 2.02 - Contractor's Title to Materials

A. The Contractor warrants that the Contractor has full, good and clear title to all materials and supplies used by the Contractor in the Work, free from all liens, claims or encumbrances.

B. All materials, equipment and articles which become the property of the Owner shall be new unless specifically stated otherwise.

Section 2.03 - "Or Equal" Clause

A. Whenever a material, article or piece of equipment or method is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade name, catalogue number, or make, no others may be substituted. Any and all other "Or Equal" considerations will be handled under this Section in accordance with General Requirements, Section 01 25 00.

B. Where the Architect approves a product proposed by the Contractor and said proposed product requires a revision or redesign of any part of the Work covered by this Contract, or the Work covered by other contracts, all said revision or redesign, and all new drawings and details required therefor shall be provided by the Contractor and shall be approved by the Architect. All time spent by the Architect or its agents to evaluate the proposed substitution and or necessary engineering cost to accommodate the requested change shall be reimbursed to the Owner by the Contractor via the Change Order procedure.

Section 2.04 - Quality, Quantity and Labeling

A. The Contractor shall furnish materials and equipment of the quality and quantity specified in the Contract. Unless otherwise provided, all materials and articles incorporated into the work shall be new and of the most suitable grade of their respective kinds for the purpose. When required by the Contract Documents or when directed by the Owner, the Contractor shall supply the Owner's Representative, for their acceptance, full information concerning any material which the Contractor contemplates incorporating into the work. Materials and articles installed or used without such acceptance shall be at the risk of subsequent rejection.

B. When materials are specified to conform to any standard, the Owner may require that the materials delivered to the Site shall bear manufacturer's labels stating that the materials meet said standards.

C. The above requirements shall not restrict or affect the Owner's right to test materials as provided in the Contract.

D. Whenever several alternative materials or items are specified by name or other particular reference for one use, the Owner's Representative may require the Contractor to submit in writing a list of the particular materials or items the Contractor intends to use before the Contract is executed.

Section 2.05 - Superintendence by Contractor

A. The Contractor shall employ a full-time effective, responsive and competent construction superintendent and necessary staff; the construction superintendent shall devote full time to the Work and shall have full authority to act for the Contractor at all times. The Contractor shall provide the Owner with the names and authority of such personnel in writing.

B. If at any time the superintendent is not satisfactory to the Owner, the Contractor shall, if requested by the Owner, replace said superintendent with another superintendent satisfactory to the Owner. There shall be no change in superintendent without the Owner's approval.

C. The Contractor shall remove from the Work any employee of the Contractor or of any Subcontractor when so directed by the Owner.

Section 2.06 - Subsurface or Site Conditions

A. The Contractor acknowledges that it has assumed the risk and that the contract consideration includes such provision as the Contractor deems proper for all subsurface conditions as the Contractor could reasonably anticipate encountering from the provisions of the Contract Documents, borings, rock cores, topographical maps and such other information as the Owner made available to the Contractor or from their own inspection and examination of the site prior to the Owner's receipt of bids.

B. In the event that the Contractor encounters subsurface physical conditions at the site differing substantially from those shown on or described or indicated in the Contract Documents and which could not have been reasonably anticipated from the aforesaid information made available by the Owner or from the Contractor's aforesaid inspection and examination of the site, the Contractor shall give immediate notice to the Owner of such conditions before they are disturbed. Such notice shall include probable cost and/or any impact to the schedule. The Owner will thereupon promptly investigate the conditions and if Owner finds that they do substantially differ from that which should have been reasonably anticipated by the Contractor, the Owner shall make such changes in the drawings and specifications as may be necessary and a change order shall be issued.

Section 2.07 - Representations of Contractor

The Contractor represents and warrants:

A. That the Contractor is financially solvent and is experienced in and competent to perform the Work;

B. That the Contractor is familiar with all Federal, State, or other laws, ordinances, orders, building codes, rules and regulations, which may in any way affect the Work;

C. That any temporary and permanent Work required by the Contract can be safely and satisfactorily constructed.

D. That the Contractor has carefully examined the Contract and the Site of the Work and that, from the Contractor's own investigations is satisfied as to the nature and location of the Work, the character, quality and quantity of surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the Work, the general and local conditions, and all other materials or items which may affect the Work. The Contractor has correlated those observations with the requirements of the Contract Documents and has made all other investigations essential to a full understanding of the Work and the difficulties which may be encountered in performing the Work.

Section 2.08 - Verifying Dimensions and Site Conditions

A. The Contractor shall take all measurements at the Site and shall verify all dimensions and site conditions at the Site before proceeding with the Work. If said dimensions or conditions are found to be in conflict with the Contract, the Contractor immediately shall refer said conflict to the Owner.

B. During the progress of Work, the Contractor shall verify all field measurements prior to fabrication of building components and equipment, and proceed with the fabrication to meet field conditions.

C. The Contractor shall consult all Contract Documents to determine exact location of all Work and verify spatial relationships of all Work. Any question concerning said location or spatial relationships shall be submitted in a manner approved by the Owner.

D. Specific locations for equipment, pipelines, ductwork and other such items of Work, where not dimensioned on plans, shall be determined in consultation with the Owner and other affected Contractors and Subcontractors.

E. The Contractor shall be responsible for the proper fitting of the Work in place.

F. Should failure of the Contractor to perform services under this section result in additional costs to the Owner, the Contractor shall be responsible for such additional costs.

Section 2.09 - Copies of Contract Documents for Contractors

A. The Owner shall furnish to the Contractor, without charge, up to five (5) sets of Contracts Documents.

B. Any sets in excess of the number mentioned above may be furnished to the Contractor at the cost of reproduction and mailing.

C. All drawings, specifications, and copies thereof furnished by the Owner are the property of the Owner. They are not to be used on other work, and with the exception of the signed Contract Set, are to be returned to the Owner on request at the completion of the work.

Section 2.10 - Meetings

The Contractor and all subcontractors as requested shall attend all meetings as directed by the Owner or the Owner's Representative.

Section 2.11 - Related Work

The Contractor shall examine the Contract for related work to ascertain the relationship of said work to the Work under the Contract.

Section 2.12 - Surveys and Layout

Unless otherwise expressly provided in the Contract, the Owner shall furnish the Contractor all surveys of the property necessary for the Work, but the Contractor shall lay out the Work.

Section 2.13 - Errors, Omissions or Discrepancies

The Contractor shall examine the Contract thoroughly before commencing the Work and report in writing any errors or discrepancies to the Owner or the Owner's Representative.

Section 2.14 - Project Labor Rates

A. The Contractor shall submit to the Owner, for review and approval, within thirty (30) days after Contract is awarded all trade labor rates inclusive of fringe benefits, taxes, insurance for the duration of the individual craft agreement in accordance with Exhibit E. Revised rates shall be provided within thirty (30) days of signing any new agreements with the individual crafts during this project.

B. The Contractor shall submit to the Owner within three days of their Bid their NYSDOL Contractor Certificate of Registration for their firm and all Subcontractors. Contractor is responsible for verifying that all of their Subcontractors are registered. Registration information is located at https://dol.ny.gov/contractor-and-subcontractor-landing.

C. The current Prevailing Wage Rate schedule is contained in the Contract Documents. All updates, corrections and future copies of the annual determination are available at the Department of Labor website (www.labor.state.ny.us).

Section 2.15 – Daily Reports

The Contractor's Construction Superintendent shall submit a Daily Report to the Cornell University Project Manager or the Resident Field Engineer at the job site. Such reports shall, at a minimum, contain the following information:

Name of Project
Project Number
Date of Report
Weather Conditions
Equipment on the site
Contractors on site including name and number of employees on site for each contractor
Work/area and activity for each contractor
Overtime worked and planned work progress
Environmental problems and corrections
Other information, such as special events, occurrences, materials delivered, accidents or injuries, recommendations, suggestions, visitors, inspections, equipment start-up and check out, occupancy, etc.

ARTICLE 3 -- INSPECTION AND ACCEPTANCE

Section 3.01 - Access to the Work

The Owner and Architect, or their duly authorized representatives, assistants, or inspectors shall at all times and for any purpose have access to the work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefor. In addition, the Contractor shall, whenever so requested, give the Owner and Architect or their duly authorized representatives access to the proper invoices, bills of lading, specifications, etc., which may be required in determining the adequacy and/or quantity of materials used in completion of the work.

Section 3.02 - Notice for Testing

If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any work to be inspected, tested, accepted, or approved, the Contractor shall give the Owner timely notice of its readiness and of the date arranged so the Owner may observe such inspection, testing, or approval. The Contractor shall bear all costs of such inspection, tests, and approvals unless otherwise provided.

Section 3.03 - Inspection of Work

A. The Contractor will cooperate in all ways to facilitate the inspection and examination of the work. The inspections and examinations will be carried out in such a manner that the work will not be delayed.

B. All Work, all materials whether or not incorporated in the Work, all processes of manufacturer, and all methods of construction shall be, at all times and places, subject to the inspection of the Owner and the Owner shall be the final judge of the quality and suitability of the Work. Any Work not approved by the Owner shall immediately be reconstructed, made good, replaced or corrected by the Contractor including all Work of other Contractors destroyed or damaged by said removal or replacement.

C. Required certificates of inspection, testing, acceptance, or approval shall be secured by the Contractor and promptly delivered to the Owner.

Section 3.04 - Inspection and Testing

All materials and equipment used in the Work shall be subject to inspection and testing in accordance with accepted standards to establish conformance with specifications and suitability for uses intended, unless otherwise specified in the Contract. If any Work shall be covered or concealed without the approval or consent of the Owner, said Work shall, if required by the Owner, be uncovered for examination. If any test results are below specified minimums, the Owner may order additional testing. The cost of said additional testing, any additional professional services required, and any other expenses incurred by the Owner as a result of said additional testing shall be paid by the Contractor. Reexamination of any part of the Work may be ordered by the Owner, and if so ordered the Work must be uncovered by the Contractor. If said Work is found to be in accordance with the Contract, the Owner shall pay the cost of reexamination and replacement. If said Work is found not to be in accordance with the Contract, the Contractor shall pay the cost of reexamination and replacement.

Section 3.05 - Defective or Damaged Work

If, in the opinion of the Owner, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the Work injured or not performed in accordance with the Contract, the compensation to be paid to the Contractor shall be reduced by an amount which, in the judgment of the Owner, shall be deemed to be equitable.

Section 3.06 - Acceptance

No previous inspection shall relieve the Contractor of the obligation to perform the Work in accordance with the Contract. No payment, either partial or full, by the Owner to the Contractor shall excuse any failure by the Contractor to comply fully with the Contract Documents. The Contractor shall remedy all defects, paying the cost of any damage to other Work resulting therefrom.

ARTICLE 4 -- CHANGES IN WORK

Section 4.01 - Changes

A. The Owner, without invalidating the Contract, may order changes within the general scope of the Contract and the Contractor shall promptly comply with such change orders.

B. A change order is a written direction to the Contractor signed by the Owner, issued after execution of the Contract, authorizing a change in the Work, extra work, or an adjustment in the Contract price or time of performance.

C. No claims for changes, extra work or additional time to complete the Contract or an adjustment in the Contract price shall be allowed unless such change is ordered in writing by the Owner.

D. The Owner shall determine the amount by which the Contract consideration is to be increased or decreased by a change order by one (1) or more of the following methods:

1. By agreement with the Contractor.

2. By applying the applicable price or prices previously bid and approved.

   (i) To the extent that Unit Prices are applicable, as determined by the Owner, work shall be priced and paid for or credited in accordance with such Unit Prices; except that a Unit Price shall not apply to any portion of work which is either reduced or increased by more than 25%. Said Unit Prices shall be valid for the duration of the project as applicable, unless stipulated elsewhere in the Contract Documents.

   (ii) For Unit Price items, additions and deletion of like items shall be algebraically summed and then multiplied by the applicable Unit Prices. For Direct Labor and Material items, all additions and deletions shall be algebraically summed for each subcontractor and then multiplied by the applicable markup.

   (iii) Unit Prices are for work complete, measured in place and cover profit and all other costs and expenses. Unit Prices include, without limit, all conditions of the contract and all general requirements such as layout, reproduction of Drawings and Specifications, testing and inspection, shop drawing and sample coordination, supervision (field and home office), small tools and expendable items, insurance, taxes, temporary facilities and services, including access and safety, "as-built" drawings, and general and administrative overhead and profit.

3. By estimating the fair and reasonable cost of:
   (i) Labor, including all wages, required wage supplements and insurance required by law paid to employees below the rank of superintendent directly employed at the Site.

   (ii) Materials

   (iii) Equipment, excluding hand tools, which in the judgment of the Owner, would have been or will be employed exclusively and directly on the Work. When submitting change orders, equipment which is common to the project scope at hand is expected to be previously paid for as overhead / general conditions to the project. Special rental equipment or tools not common to the project that are required to perform the change order will be accepted as additional costs.

4. By determining the actual cost of the extra work in the same manner as in Subsection 3 except the actual costs of the Contractor shall be used in lieu of estimated costs.

E. Mark-up Percentages

1. Work performed by the Contractor: Where the Work is performed directly by the Contractor by adding to the total of such estimated costs a sum equal to fifteen percent (15%) thereof.

2. Work performed by a Subcontractor: Where the change order work is performed by a Subcontractor under contract with the Contractor, by adding a sum equal to fifteen (15%) of said costs for the benefit of said Subcontractor, and by adding for the benefit of the Contractor an additional sum equal to ten percent (10%) of said costs.

3. Work performed by a Sub-Subcontractor: Where work is performed by a Sub-Subcontractor, by adding the sum equal to fifteen percent (15%) of said costs for the benefit of said Sub-Subcontractor, by adding for the benefit of the Subcontractor an additional sum equal to five percent (5%) of said cost and by adding for the benefit of the Contractor an additional sum equal to five percent (5%) of said cost. The maximum aggregate of all mark-up percentages may not exceed twenty five percent (25%).

4. No Markup on Bonds and Insurance Costs: Change Order cost adjustments due to increases or decreases in bond or insurance costs (if applicable) shall not be subject to any Markup Percentage.

5. Overtime Pay: No mark-up shall be paid on the premium portion of overtime pay.

6. Direct and Indirect Costs Covered by Markup Percentages: As a further clarification, the agreed upon Markup Percentage is intended to cover the Contractor's profit and all indirect costs and expenses associated with the change order work. Items intended to be covered by the Markup Percentage include, without limit: home office expenses, branch office and field office overhead expense of any kind; project management; superintendents, general foremen; estimating, engineering; coordinating; expediting; purchasing; detailing; legal, accounting, data processing or other administrative expenses; reproduction of drawings and specifications; shop drawings and sample coordination; “as-built” drawings; permits; auto insurance and umbrella insurance; pick-up truck costs; parking permits; cellular phones; testing and inspection; temporary facilities; access and safety provisions; and warranty expense costs. The cost for the use of small tools and/or tools already in use on site are also to be considered covered by the Markup Percentage. Small tools shall be defined as tools and equipment (power or non-power) with an individual purchase cost of less than $750

7. Deduct Change Orders and Net Deduct Changes: The application of the markup percentage will apply to both additive and deductive change orders. In the case of a deductive change order, the credit will be computed by applying the percentage so that a deductive change order would be computed in the same manner as an additive change order. In those instances where a change involves both additive and deductive work, the additions and deductions will be netted and the markup percentage adjustments will be applied to the net amount

F. Regardless of the method used by the Owner in determining the value of a change order, the Contractor, within thirty (30) calendar days after a request for the estimate of value shall submit to the Owner a detailed breakdown of the Contractor's estimate, including all subcontractors details, of the value of the Change Order Work, in the format detailed in Exhibit A. Each submission shall include an electronic .pdf format of all documentation.

G. Unless otherwise specifically provided for in a change order, the compensation specified therein includes a full payment for both the Work covered by the order and for any damage or expense incurred by the Contractor by any delays, including any delays to other Work to be done under the Contract resulting from said change order. The Contractor waives all rights to any other compensation for said damage or expense.

H. The Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner shall give the Owner access to accounts and records relating thereto.

Section 4.02 – Claims for Extra Work

If the Contractor claims (i) that any work it has been ordered to do is extra work or (ii) that it has performed or is going to perform extra work or (iii) that any action or omission of the Owner or the Architect is contrary to the terms and provisions of the Contract, the Contractor shall:

A. Promptly comply with such order;

B. Notwithstanding the provisions of this Agreement, Article 4 of these General Condition and any other provisions of the Contract documents to the contrary, file with the Owner, within fourteen (14) calendar days after being ordered to perform the work claimed by it to be extra work or within fourteen (14) calendar days after commencing performance of the extra work, whichever date shall be the earlier, or within fourteen (14) calendar days after the said action or omission on the part of the Owner or the Architect occurred, a written notice of the basis of its claim and request a determination thereof;

C. Notwithstanding the provisions of this Agreement and any other provisions of the Contract documents to the contrary, file with the Owner, within thirty (30) calendar days after said alleged extra work was required to be performed or said alleged extra work was commenced, whichever date shall be the earlier, or said alleged action or omission by the Owner or the Architect occurred, a verified detailed statement, with documentary evidence, of the items and basis of its claim;

D. Produce for the Owner’s examination, upon notice from the Owner, all its books of account, bills, invoices, payrolls, subcontracts, time books, progress records, daily reports, bank deposit books, bank statements, checkbooks and cancelled checks, showing all of its actions and transactions in connection with or relating to or arising by reason of its claim, and submit persons in its employment and in its subcontractors' employment for examination under oath by any person designated by the Owner to investigate any claims made against the Owner under the Contract, such examination to be made at the offices of the Contractor; and

E. Proceed diligently, pending and subsequent to the determination of the Owner with respect to any such disputed matter, with the performance of the Contract and in accordance with all instructions of the Owner and the Architect.

F. The Contractor's failure to comply with any or all parts of Section 4.02 shall be deemed to be: (i) a conclusive and binding determination on its part that said order, work, action or omission does not involve extra work and is not contrary to the terms and provisions of the Contract; and (ii) a waiver by the Contractor of all claims for additional compensation or damages as a result of said order, work, action or omission. The provisions of Section 4.02 is to promptly afford the Owner opportunity to cancel or revise any order, change its plans, mitigate or remedy the effects or circumstances giving rise to a claim or take such other action as may seem desirable and to verify any claimed expenses or circumstances as they occur. Compliance with such provisions is essential whether or not the Owner is aware of the circumstances of any order or other circumstances which might constitute a basis for a claim and whether or not the Owner has indicated it will consider a claim in connection therewith.

G. No person has power to waive or modify any of the foregoing provisions and, in any action against the Owner to recover any sum in excess of the sum certified by the Owner to be due under or by reason of the Contract, the Contractor must allege in its complaint and prove compliance with the provisions of this Section.

Section 4.03 - Form of Change Orders

All change orders shall be processed, executed and approved via the Owner's electronic project management system Change Order Process. No payment for change order Work shall be due the Contractor unless a change order has been issued and approved as noted above.

ARTICLE 5 -- TIME OF COMPLETION

Section 5.01 - Time of Completion

A. The Work shall be commenced at the time stated in the written order of the Owner and shall be completed no later than the date of completion specified in the Contract. All required overtime to maintain progress schedule is included in the Base Bid.

B. The date of beginning and the time for completion of the Work, as specified in the Contract, are essential conditions of the Contract.

C. The Work shall be prosecuted diligently at such rate of progress as shall insure full completion within the time specified. It is expressly understood and agreed, that the time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic range and usual business and labor conditions prevailing in the locality of the Site.

D. Time is of the essence on each and every portion of the Work. In any instance in which additional time is allowed for the completion of any Work, the new time of completion established by said extension shall be of the essence. If in the Architect’s or Owner's judgment, it becomes necessary at any time during construction to accelerate and/or complete certain areas of the project, the Contractor shall concentrate efforts and manpower on designated areas.

E. Where Work occurs within occupied areas, perform same only on approved schedule, so as not to interfere with normal operation of occupied areas.

F. The Contractor shall not be charged with damages or any excess cost if the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner. The Contractor shall not be charged with damages or any excess cost for delay in completion of the work if the Owner determines that the delay is due to:

1. any preference, priority or allocation order duly issued by the Government of the United States or the State of New York;

2. unforeseeable cause beyond the control and without the fault or negligence of the Contractor, and approved by the Owner, including, but not limited to, acts of God or of public enemy, acts of the Owner, fires, epidemics, quarantine, restrictions, strikes, freight embargoes and unusually severe weather.

G. The time for completion can only be extended by change order and may be extended for:

1. all of the Work, or

2. only that portion of the Work altered by the change order.

H. Any claim for extension of time shall be made in writing to the Owner not more than ten (10) days after the commencement of the delay; otherwise it shall be waived.

ARTICLE 6 -- TERMINATION

Section 6.01 - Termination for Cause

In the event that any provision of this Contract is violated by the Contractor or by any Subcontractor of the Contractor, the Owner may serve written notice upon the Contractor, and upon the Contractor's surety, if any, of the Owner's intention to terminate the Contract. The notice shall briefly state the reasons for the termination and shall specify a termination date. If arrangements satisfactory to the Owner are not made to remove and remedy the violation, the Contract shall terminate upon the date specified by the Owner in the notice. In the event of termination, the Owner may take over and complete the Work at the expense of the Contractor. The Contractor and Contractor's surety shall be liable to the Owner for all costs thereby incurred by the Owner. In the event of such termination the Owner may take possession of and may utilize such materials, appliances, and plant as may be located on the Site and which may be necessary or useful in completing the Work.

Section 6.02 - Termination for Convenience of Owner

The Owner, at any time, may terminate the Contract in whole or in part. Any said termination shall be effected by delivering to the Contractor a notice of termination specifying the extent to which performance of Work under the Contract is terminated and the date upon which said termination becomes effective. Upon receipt of the notice of termination, the Contractor shall act promptly to minimize the expenses resulting from said termination. The Owner shall pay the Contractor for costs actually incurred by the Contractor up to the effective date of said termination, but in no event shall the Contractor be entitled to compensation in excess of the total consideration of the Contract. In the event of said termination the Owner may take over the Work and prosecute same to completion.

Section 6.03 – Termination under New York State Finance Law §139-k

The Owner reserves the right to terminate this contract in the event it is found that the certification filed by the Contractor in accordance with New York State Finance Law §139-k was intentionally false or intentionally incomplete. Upon such finding, the Owner may exercise its termination right by providing written notification to the Contractor in accordance with the written notification terms of this contract.

Section 6.04 - Owner's Right to do Work

The Owner may, after notice to the Contractor, without terminating the Contract and without prejudice to any other right or remedy the Owner may have, perform or have performed by others all of the Work or any part thereof and may deduct the cost thereof from any monies due or to become due the Contractor.

ARTICLE 7 -- DISPUTES

Section 7.01 - Disputes Procedure

A. If the Contractor claims that any Work which the Contractor has been ordered to perform will be Work which should have been authorized or directed by change order, or that any action or omission of the Owner is contrary to the terms of the Contract, the Contractor shall:

1. File a notice with the Owner which sets forth the basis of the Contractor's claim and requests a resolution of the dispute. Such notice shall be filed within fifteen (15) working days after being ordered to perform the disputed work or within fifteen (15) working days after commencing performance of the disputed work, whichever is earlier, or within fifteen (15) working days after the act or omission of the Owner which the Contractor claims is contrary to the terms of the Contract.

2. Proceed diligently with the performance of the work in accordance with the instructions of the Owner pending the resolution of the dispute by the Owner.

3. Promptly comply with the order of the Owner regarding the disputed matter.

4. Any such decision, or any other decision of the Owner in respect to a dispute, shall be final unless the Contractor, within ten (10) working days after such decision, shall deliver to the Owner a verified written statement which sets forth the Contractor's contention that the decision is contrary to a provision of the contract. Pending the decision of the Owner, the Contractor shall proceed in accordance with the original decision. The Owner shall determine the validity of the Contractor's claim and such determination shall be final. The Contractor may file a notice with the Owner reserving its rights in connection with the dispute but shall comply with the Owner's decision and complete the work as directed.

B. No claim for additional costs regarding changed or extra work shall be allowed unless the work was done pursuant to a written order of the Owner.

C. The value of claims for extra work, if allowed, shall be determined by the methods described in the Contract. Refer to Article 4 of these General Conditions.

D. The Contractor's failure to comply with any or all parts of Article 7 shall be deemed to be:

1. a conclusive and binding determination on the part of the Contractor that the order, work, action or omission is not contrary to the terms and provisions of the Contract;

2. a waiver by the Contractor of all claims for additional compensation, time extension, or damages as a result of said order, work, action or omission.

ARTICLE 8 -- SUBCONTRACTS

Section 8.01 - Subcontracting

A. The Contractor may utilize the services of Subcontractors.

B. The Contractor shall submit to the Owner, in writing, the name of each proposed Subcontractor and Sub-Subcontractor, as required by the Contract. The Contractor shall not award any Work to any Subcontractor or Sub-Subcontractor without the prior written approval of the Owner.

C. The Contractor shall be fully responsible for the Work, acts and omissions of Subcontractors, and of persons either directly or indirectly employed by Subcontractors.

D. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract insofar as applicable to the Work of Subcontractors, indemnification and to give the Contractor the same power to terminate any subcontract that the Owner may exercise over the Contractor.

E. The Contractor's use of Subcontractors shall not diminish the Contractor's obligation to complete the Work in accordance with the Contract. The Contractor shall control and coordinate the Work of Subcontractors.

F. Nothing contained in the Contract shall create any contractual relationship between Subcontractors and the Owner.

ARTICLE 9 -- COORDINATION AND COOPERATION

Section 9.01 - Cooperation with Other Contractors

A. Normally, the Work will be performed by a single Contractor. However, the Owner reserves the right to perform work related to the Work with its own forces or award separate contracts. In that event, the Contractor shall coordinate its operations with the Owner's forces or separate Contractors.

B. The Owner cannot guarantee the responsibility, efficiency, unimpeded operations or performance of any contractor. The Contractor acknowledges these conditions and shall bear the risk of all delays including, but not limited to, delays caused by the presence or operations of other contractors.

C. The Contractor shall keep informed of the progress and workmanship of other contractors and shall notify the Owner immediately of lack of progress or defective workmanship on the part of other contractors where said delay or defective workmanship may interfere with the Contractor's operations.

D. Failure of a Contractor to keep so informed and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by the Contractor of said progress and workmanship as being satisfactory for proper coordination with the Work.

E. If the Contractor notifies the Owner, in writing, that another contractor on the Site is failing to coordinate the work of said contractor with the Work, the Owner shall investigate the charge. If the Owner finds it to be true, the Owner shall promptly issue such directions to the other contractor with respect thereto as the situation may require. The Owner shall not be liable for any damages suffered by the Contractor by reason of the other contractor's failure to promptly comply with the directions so issued by the Owner, or by reason of another contractor's default in performance.

F. If the Owner shall determine that the Contractor is failing to coordinate the Work with the work of other contractors as the Owner has directed:

1. the Owner shall have the right to withhold any payments due under the Contract until the Owner's directions are complied with by the Contractor; and

2. the Contractor shall indemnify and hold the Owner harmless from any and all claims or judgments for damages and from any costs or damages to which the Owner may be subjected or which the Owner may suffer or incur by reason of the Contractor's failure promptly to comply with the Owner's directions.

G. Should the Contractor sustain any damage through any act or omission of any other contractor having a contract with the Owner or through any act or omission of any Subcontractor of said other contractor, the Contractor shall have no claim against the Owner for said damage.

H. Should any other contractor having a Contract with the Owner sustain damage through any act or omission of the Contractor or its Subcontractor, the Contractor shall reimburse said other contractor for all said damages and shall indemnify and hold the Owner harmless from all said claims.

ARTICLE 10 -- PROTECTION OF RIGHTS, PERSONS AND PROPERTY

Section 10.01 - Accidents and Accident Prevention

A. The Contractor shall at all times take reasonable precautions for the safety of persons engaged in the performance of the work. The Contractor shall comply fully with all applicable provisions of federal, state, and local law. The Contractor alone shall be responsible for the safety, efficiency and adequacy of the Contractor's Work, plant, appliances and methods, and for any damage which may result from the failure or the improper construction, maintenance, or operation of said Work, plant, appliances and methods.

B. The Contractor shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of or in the course of employment on Work under the Contract, and shall immediately notify the Owner in writing of any injury which results in hospitalization or death, or significant near miss incidents that had the potential to result in serious injury or death. The Contractor shall upload all completed Contractor and Subcontractor incident investigation forms and reports within five (5) working days of the incident. The report shall include the extent of damage or injury, the persons involved and their employers, the number of days persons are hospitalized, and any other pertinent information required by Cornell University. Such reporting shall be submitted on the electronic project management system Accident Form.

C. The Contractor shall provide to the Project Manager, Material Safety Data Sheets (OSHA Form 20 or the equivalent) for all chemicals to be used on site. All chemicals requiring any precautionary measures (eg. special storage or disposal requirements, personal protective equipment, or additional ventilation), shall be brought to the attention of Cornell University for review and approval, prior to their use on site.

1. All chemicals brought on site by the Contractor shall be clearly labeled. The label shall state the identity of the chemical, any associated hazards, and the Contractor's name.

2. All Contractor employees who are using chemicals shall be made aware of the hazards associated with their use. Safe chemical handling procedures in accordance with OSHA or other governmental agencies, and manufacturer's recommendations shall be used at all times.

3. The Contractor shall dispose of all chemicals in accordance with EPA and Cornell University requirements, regardless of the size of the container or the quantity of waste, and must receive prior approval of Cornell University.

4. A Contractor's Waste Material Disposal Plan form is required (with or without waste) to be submitted with submission of the first payment. The form can be found at: https://ehs.cornell.edu/sites/default/files/FRM-CWMDP-Contractor-Waste-Material-Disposal-Plan-IPDF.pdf

D. The Contractor shall be responsible for the initiation, maintenance and supervision of safety precautions and programs in connection with the Work.

E. The Contractor shall, at all times, guard the Owner's property from injury or loss in connection with the Work. The Contractor shall, at all times, guard and protect the Contractor's Work. The Contractor shall replace or make good any said loss or injury unless said loss or injury is caused directly by the Owner.

F. The Contractor shall have full responsibility to install, protect and maintain all materials and supplies in proper condition and forthwith repair, replace and make good any damage thereto until Final Acceptance.

Section 10.02 - Adjoining Property

A. The Contractor shall be required to protect all the adjoining property and to repair or replace any such properties damaged or destroyed by the Contractor, its employees or subcontractors thereof, by reason of, or as a result of activities under, for or related to the Contract.

Section 10.03 - Emergencies

A. In case of an emergency which threatens loss or injury to persons or property, the Contractor will be allowed to act, without previous instructions from the Owner, in a diligent manner, to the extent required to avoid or limit such loss or injury, and the Contractor shall notify the Owner immediately thereafter of the action taken.

Section 10.04 - Bonds

A. Before commencing the performance of any work covered by the Contract, the Contractor shall furnish to the Owner any required Bonds. The failure of the Contractor to supply the required Bonds within ten (10) days after the Contract signing shall constitute a default.

Section 10.05 - Risks Assumed by the Contractor

A. Indemnification. The Contractor shall defend, indemnify and hold harmless the Owner and its trustees, officers, agents and employees from and against all claims, damages, losses, fines, and expenses, including reasonable attorneys' fees, arising out of or resulting from the performance of the work including, but not limited to, bodily or personal injury, sickness, disease, death, or injury or damage to tangible property, to the extent they arise out of or result from:

1. any negligent act or omission, or intentional or willful misconduct, violation of law, or breach of this Contract by the Contractor, or any of its subcontractors, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, or

2. any injury to an employee of the Contractor, its subcontractors, anyone directly or indirectly employed by them. The indemnification obligation under this section shall not be limited by the amount or type of damages, compensation or benefits payable by or for the Contractor under workers' compensation, disability benefit or other employee benefit laws.

B. In the event that Contractor is requested but refuses to honor its indemnification obligations hereunder, then the Contractor shall, in addition to all other obligations, pay the cost, including reasonable attorneys' fees, of bringing an action to enforce such indemnification obligations.

C. Neither the Owner's final acceptance of the work to be performed hereunder nor the making of any payment shall release the Contractor from its obligations under this Section. The enumeration elsewhere in the Contract of particular risks assumed by the Contractor or of particular claims for which the Contractor is responsible shall not be deemed to limit the effect of the provisions of this Section or to imply that the Contractor assumes or is only responsible for risk or claims of the type enumerated.

Section 10.06 - Contractor's Compensation and Liability Insurance

A. The Contractor shall procure and maintain, at its own cost and expense, until final acceptance by the Owner of all the work covered by this Contract, the following kinds of insurance:

1. Worker's Compensation Insurance. A policy complying with the requirements of the laws of the State of New York, including Coverage B - Employer's Liability with limits as follows: (1) Bodily injury by accident - $1,000,000 each accident; (2) Bodily injury by disease - $1,000,000 each employee; and (3) Bodily injury by disease - $1,000,000 policy limit. This policy shall provide a Waiver of Subrogation in favor of the Owner.

2. Contractor's Comprehensive General Liability Insurance. A standard commercial general liability insurance policy, with contractual, completed operations, explosion, collapse and underground property damage coverage's issued to and covering the liability of the Contractor for all work and operations under this Contract and all obligations assumed by the Contractor under this Contract. The Contractor shall provide Broad Form Commercial General Liability Insurance, and the Owner shall be an additional insured in the policy utilizing additional insured endorsements CG 20 10 10 01 and CG 20 37 10 01 or their equivalents and provide a Waiver of Subrogation in favor of Owner. The completed operations coverage's shall be maintained for not less than two years after acceptance of the work or until the end of the applicable Statute of Repose, whichever is greater. The limits of the Commercial General Liability policy shall be as follows:

$ 1,000,000	Each Occurrence
$ 1,000,000	Personal and Advertising Injury per Occurrence
$ 2,000,000	General Aggregate
$ 2,000,000	Completed Operations

a) No exclusionary language or limitations relating to soils or earth movement.

b) No exclusions for Bodily Injury and Property Damage, Labor Law (240) products liability/completed operations coverage (including any product manufactured or assembled), premises operations, blanket contractual liability (for this agreement), broad form property damage, personal and advertising injury, independent contractor's liability, mobile equipment, elevators, damage from explosion, collapse and underground hazards ("XCU") cross-liability, cross suits or severability of interest clauses are acceptable.

3. Automobile Liability Insurance. A policy covering the use in connection with the work covered by the Contract Documents of all owned, non-owned and hired vehicles bearing, or, under the circumstance under which they are being used, required by the Motor Vehicle Laws of the State of New York to bear license plates. This policy shall name Owner as an Additional Insured and provide a Waiver of Subrogation in favor of Owner. The coverage under such policy shall be not less than a combined single limit for Bodily Injury and Property Damage of:

COMBINED SINGLE LIMIT

$ 1,000,000 Each Accident

4. Umbrella Liability Insurance. Umbrella and/or Excess Liability policy(ies) will be provided on a following form basis subject to limits not less than $10,000,000 per occurrence and follow-form of the primary General Liability, Automobile Liability, and Employers Liability policies. These policies shall contain an endorsement stating that any entity qualifying as an additional insured on the insurance stated in the Schedule of Underlying Insurance shall be an Additional Insured on the Umbrella/Excess liability policy and that they apply immediately upon exhaustion of the insurance stated in the Schedule of Underlying Insurance as respects to the coverage afforded to any Additional Insured. No trailing retentions on Umbrella or Excess Liability policy(ies) shall be allowed without Owner prior written consent. When approved in advance by Owner, the policies provided in this section may have policy limits lower than indicated above if the excess liability insurance policy limits provided by Contractor, when combined with the corresponding underlying policy limits, total at least the sum of all required minimum policy limits required by this section.

$ 10,000,000 Each Occurrence/Aggregate

5. Professional Liability Insurance. I Contractor shall purchase and maintain Contractor's Professional Liability Insurance if Contractor or any of its Subcontractors or agents will provide any design, engineering or other professional services under the Subcontract Documents, covering Subcontractor and Sub-subcontractors, and their respective professionals, for liability for negligent acts, errors, or omissions, arising out of the performance of the Contractor's Work. The Retroactive date must be prior to start of the Work required under this Agreement. Coverage must be maintained for a minimum period of 2 years or until the applicable Statute of Repose, whichever is greater. The policy shall contain a blanket endorsement for contractual liability and afford coverage on a claim made basis:

$ 2,000,000 Each Occurrence Aggregate

6. Contractors Pollution Liability Insurance: Contractor shall purchase and maintain Pollution Liability Insurance as will protect the Owner and Contractor from claims of Bodily Injury, Property Damage and cleanup, which may arise out of or result from Contractor's operations under the Contract and for which the Contractor may be legally liable. Pollution liability coverage shall extent to microbial matter including mold, mold remediation and diminution in value. The insurance shall be maintained from inception of the Work through the earlier of Substantial Completion or Final Payment. This insurance shall include coverage and limits as follows.

$ 2,000,000 Each Occurrence/Aggregate

7. Contractor's Equipment. Contractor shall purchase and maintain coverage for its property and equipment to be used in the prosecution of the Contract Work. Such coverage shall be on a Replacement Cost basis. A Waiver of Subrogation in favor of Owner for any loss to Contractor's tools, equipment, machinery, and appliances shall be provided prior to the commencement of the Contract Work.

B. In addition to maintaining all of the above insurances, the Contractor shall indemnify and hold harmless the Owner and its agents and employees from and against liability, including additional premium due because of the Contractor's failure to maintain coverage limits as required under this section.

C. Insurance similar to that required of the Contractor shall be provided by or on behalf of all subcontractors to cover their own operations performed under this Contract. The Contractor shall be held responsible for any modifications in these insurance requirements as they apply to subcontractors.

A. Subcontractors' Insurance: Before permitting any of its Subcontractors to perform any Work, Contractor shall require and verify that all subcontractors maintain insurance meeting all the requirements stated herein, and Contractor shall ensure that Owner is an additional insured on insurance required from subcontractors. Such Additional Insured endorsement shall be attached to the certificate of insurance in order to be valid and on a form at least as broad as ISO Additional Insured Endorsement CG2010 1093 with CG2037 1001 or an endorsement providing equivalent or broader coverage. The policy shall not contain any exclusions for New York Labor Law§§ 200, 240, 240(1), 241, 241(6) and any related sections, and their insurance certificate or accompanying letter from Authorized Representative must specifically state the same. If any sub contractor's coverage does not comply with the foregoing provisions, Contractor shall defend and indemnify the Owner from any damage, loss, cost, or expense, including attorneys' fees, incurred by Owner as a result of subcontractor's failure to maintain required coverage.

B. Subcontractor insurance shall be in such amounts and against such risks as is consistent with Contractor's customary practices for such types of subcontracts for projects of similar type and capacity to the Project, PROVIDED that such insurance shall at least be in such amounts and against such risks as is customarily carried by persons engaged in similar businesses in the same geographic area.

C. Applicable subcontractor minimum insurance limits shall be:

For Subcontracts $1,000,000 or less:

- Workman's compensation as per Section 10.06.A.1
- Comprehensive General Liability as per Section 10.06.A.2 with the following limits:

BODILY INJURY AND PROPERTY
DAMAGE LIABILITY (BROAD FORM)
$ 1,000,000 Each Occurrence
$ 2,000,000 Aggregate

- Automobile Liability Insurance as per Section 10.06.A3

- Professional Liability Insurance – if applicable to the Subcontractor's Scope of Work – as per Section 10.06.A.5 with the following limits:

  Minimum Limits Required: $2,000,000 per claim and $2,000,000 aggregate

- Umbrella/Excess Liability as per Section 10.06A.4 with the following limits:

  Not less than $5,000,000 per occurrence

- Pollution Liability Insurance as per section 10.06.A.6 with the following limits:

  Not less than $2,000,000 aggregate

For Subcontracts $1,000,000 or more:

- Workman's compensation as per Section 10.06.A.1
- Comprehensive General Liability as per Section 10.06.A.2 with the following limits:

  BODILY INJURY AND PROPERTY
  DAMAGE LIABILITY (BROAD FORM)
  $ 1,000,000 Each Occurrence
  $ 2,000,000 Aggregate

- Automobile Liability Insurance as per Section 10.06.A3
- Professional Liability Insurance – if applicable to the Subcontractor's Scope of Work – as per Section 10.06.A.5 with the following limits:

  Minimum Limits Required: $2,000,000 per claim and $2,000,000 aggregate

- Umbrella/Excess Liability as per Section 10.06A.4 with the following limits:

  Not less than $10,000,000 per occurrence

- Pollution Liability Insurance as per section 10.06.A.6 with the following limits:

  Not less than $5,000,000 aggregate

D. Before commencing the performance of any work covered by the Contract, the Contractor shall furnish to the Owner a current certificate or certificates, in duplicate, of the insurance required under the foregoing provisions including copies of subcontractor's certificates. Such certificates shall be on a form prescribed by the Owner, shall list the various coverage's and shall contain, in addition to any provisions hereinbefore required, a provision that the policy shall not be changed or cancelled and that it will be automatically renewed upon expiration and continued in force until final acceptance by the Owner of all the work covered by the Contract, unless the Owner is given thirty (30) days written notice to the contrary. Upon renewal of each of the Contractor's insurance coverage's, the Owner shall be provided with a new certificate of insurance showing such renewal. Certificates and written notices shall be directed to the Office of Facilities Contracts. The Contractor shall furnish the Owner with a certified copy of each policy including any and all exclusions to such policy.

E. If at any time any of the above required insurance policies should be cancelled, terminated or modified so that insurance is not in effect as above required, then, if the Owner shall so direct, the Contractor shall suspend performance of the work covered in the Contract. If the said work is so suspended, no extension of time shall be due on account thereof. The Owner may, at its option, obtain insurance affording coverage equal to that above required, at the Contractor's expense.

Section 10.07 - Liability Insurance of the Owner

A. The Owner, at its own cost and expense, shall procure and maintain such liability insurance as will, in its opinion, protect the Owner from its contingent liability to others for damages because of bodily injury, including death, and property damage which may arise from operations under this Contract.

Section 10.08 - Owner's and Contractor's Responsibilities for Fire and Extended Coverage Insurance Hazards

A. The Contractor shall purchase and maintain in force a builders risk insurance policy on the entire work. Such insurance shall be written on a completed value form and in an amount equal to the initial contract sum and modified by any subsequent modifications to the contract sum. The insurance shall name Cornell University and the State of New York, all subcontractors and sub- subcontractors as additional insureds. The insurance policy shall contain a provision that the insurance will not be cancelled or allowed to expire until the Contractor has given at least thirty (30) days prior written notice to Cornell University. The insurance shall cover the entire work at the site, including reasonable compensation for Architect's services and expenses made necessary by an insured loss. Insured property shall include portions of the work located away from the site and in transit to the site. The policy shall cover the cost of removing debris and demolition as may be legally necessary. The policy shall cover any boiler or machinery loss which may be suffered during installation and until final acceptance. The insurance required shall be written to cover "all risk" of physical loss including a loss due to collapse. Any deductible shall be the responsibility of the Contractor but in no case shall the deductible be more than $10,000 unless Cornell University has agreed to a higher deductible. The Contractor shall provide to Cornell University a certificate of insurance and a summary of coverage's including all endorsements and exclusions prior to commencement of the work. Once the policy is received, the Contractor shall provide a copy of such policy to Cornell University. There shall be a mutual waiver of recovery between Cornell University, the Contractor and all other parties to the extent such losses are covered by the builders risk policy. If Cornell University wishes to occupy the building prior to final acceptance and if the policy contains a provision which limits coverage for such partial occupancy, the parties agree work together to obtain consent of the insurance company for such partial occupancy or use under mutually acceptable terms.

B. Losses, if any, under such insurance shall be payable to the Owner.

C. The Contractor shall be responsible for any and all loss of materials connected with the construction due to unexplainable disappearance, theft or misappropriation of any kind or nature.

D. The foregoing provisions shall not operate to relieve the Contractor and subcontractors of responsibility for any loss or damage to their own or rented property or property of their employees, of whatever kind or nature, or on account of labor performed under the Contract incidental to the repair, replacement, salvage, or restoration of such items, including but not limited to tools, equipment, forms, scaffolding, and temporary structures, including their contents, regardless of ownership of such contents, except for such contents as are to be included in and remain a part of the permanent construction. The Owner shall in no event be liable for any loss or damage to any of the aforementioned items, or any other property of the Contractor, subcontractors and the Architect, or employees, agents, or servants of same, which is not to be included in and remain a part of the permanent construction. The Contractor and subcontractors severally waive any rights of recovery they may have against the Owner and the Architect for damage or destruction of their own or rented property, or property of their employees of whatever kind or nature.

Section 10.09 - Effect of Procurement of Insurance

A. Neither the procurement nor the maintenance of any type of insurance by the Owner or the Contractor shall in any way be construed or be deemed to limit, discharge, waive or release the Contractor from any of the obligations and risks imposed upon the Contractor by the Contract or to be a limitation on the nature or extent of such obligations and risks.

Section 10.10 - No Third Party Rights

A. Nothing in the Contract shall create or give to third parties; any claim or right of action against the Contractor, the Architect, and the Owner beyond such as may legally exist irrespective of the Contract.

Section 10.11 – Assumption of Risk

Vendors/Consultants/Contractors/Subcontractors are required to bring to jobsite all tools, equipment, and applicable personal safety devices required or needed to perform and complete the relevant scope of Work. Use of Cornell equipment or tools, with or without permission, involves inherent risk of injury to User(s). Any use of Cornell equipment is conditioned upon the assumption of all risks attendant to the use of any tools or equipment – including personal injury, death or permanent disability – arising from the Use of Cornell equipment or tools. These risks also include but are not limited to: accidents, collisions, falling, as well as unforeseen risks resulting in injuries to User and/or bystanders. Participation in a walk-through or similar activity constitutes acceptance of risk assumption.

Section 10.12 - Health And Safety Plan Requisites for Construction Activity Applicable To High Impact Respiratory Pathogen Pandemics And Contagions

Contractor agrees it shall follow all applicable safety requirements to a prospective health and safety event, emergency, epidemic or pandemic. Contractor is required to protect the health and safety of employees as required by applicable law, rule, regulation, and/or protocols based upon then current information, requirements, recommendations, and guidelines from civil authorities including, but not limited to, federal or New York State Executive Orders, CDC, OSHA and New York State Department of Health surrounding health and safety measures designed to eliminate or reduce the transmission of the high impact respiratory pathogen pandemics (HIRPP), or other emergent public health and safety events, epidemics, pandemics and conditions.

ARTICLE 11 -- USE OR OCCUPANCY PRIOR TO ACCEPTANCE BY OWNER

Section 11.01 – Substantial Completion

A. The term "substantial completion" means the completion of the Work to the extent that Cornell University may have uninterrupted occupancy or use of the facility or specified portion thereof for the purpose for which intended. The Contractor shall obtain all certificates of occupancy required prior to occupancy, and any electrical, mechanical and plumbing certificates, or other certificates or required approvals and acceptances by City, County, and State governments or other authority having jurisdiction.

Section 11.02 - Occupancy Prior to Acceptance

A. If, before Final Acceptance, the Owner desires Beneficial Occupancy of the Work, or any part thereof, which is completed or partly completed, or to place or install therein equipment and furnishings, the Owner shall have the right to do so, and the Contractor shall in no way interfere with or object to said Beneficial Occupancy by the Owner.

B. Said Beneficial Occupancy (1) shall not constitute acceptance of space, systems, materials or elements of the Work, nor shall said Beneficial Occupancy affect the start of any guarantee period, and (2) shall not affect the obligations of the Contractor for Work which is not in accordance with the requirements of the Contract or other obligations of the Contractor under the Contract.

C. The Contractor shall continue the performance of the Work in a manner which shall not unreasonably interfere with said use, occupancy and operation by the Owner.

ARTICLE 12 -- PAYMENT

Section 12.01 - Provision for Payment

A. The Owner agrees to pay the Contract Price to the Contractor for the performance of this Contract and the fulfillment of all the Contractor's obligations. The Contract Price means all costs reimbursable under the Contract Documents.

B. The final certificate of the Architect shall certify that the Contract has been completed within the stipulated time, and shall not be issued until all drawings and specifications have been returned to the Owner. The issuance of said certificates, however, or any payments made thereon shall not lessen the total responsibility of the Contractor to complete the work to the satisfaction of the Owner in accordance with the Contract.

C. Payments on the Contract Price shall be made each month as the work progresses in accord with the following procedure:

1. The Contractor's schedule of values, including quantities, aggregating the total Contract Price, divided so as to facilitate payments to subcontractors as specified herein, shall be the basis for monthly progress payments. This schedule, as shown in the electronic project management system Schedule of Values Process, when approved by the Owner shall be used as a basis for progress payments. In applying for payments, the Contractor shall submit a statement based upon this approved schedule.

2. (a) On a date agreed upon by the Owner, Architect, and Contractor, a meeting shall be held by the Owner to review the work completed and materials on hand. This meeting shall review each item to be submitted by the Contractor in the requisition for payment.

(b) On the first day of each month, or as soon thereafter as practicable, the Contractor shall submit via the electronic project management system Payment Application Process, a statement and all applicable documentation setting forth in detail the cost of the work done and materials delivered to the job site up to and including the last day of the previous month and shall make application for payment of ninety five percent (95%) of the amount of said statement, less the aggregate of all previous payments made by the Owner against the Contract Price.

(c) Each statement and application shall be accompanied by an affidavit, executed by the Contractor, certifying that the statement is true and correct, and that all bills for labor, and materials incorporated in or delivered to the job, due and payable at the time of the preceding progress payment, have been paid. The Contractor shall attach a single .pdf file of certified payrolls for all employees on the project as indicated in the electronic project management system Payment Application Process. Before final payment is made, the Contractor shall submit evidence that all payrolls, material bills and other indebtedness incurred in connection with the Contract have been paid, including final waivers of any liens.

3. Each such application for payment shall be subject to the review and approval of the Architect. If the Architect finds that the affidavit and application for payment are acceptable and that all the above requirements in connection therewith have been complied with, the Architect shall, within seven (7) calendar days after receiving such application for payment, certify to the Owner that the payment applied for is due and payable to the Contractor.

4. The issuance of a Certificate for Payment constitutes a representation by the Architect to the Owner, based on the date of the Application for Payment, that the work has progressed to the point indicated, that, to the best of their knowledge, information, and belief, the quality of the work is in accordance with the Contract Documents and that the Contractor is entitled to payment in the amount certified.

The Owner shall make payment in the manner provided in the Agreement within thirty (30) calendar days of receipt of the approved Certificate in the Electronic project management system.

Approval of the Payment Application by the Architect shall not be deemed to represent that the Architect has made exhaustive or continuous on-site inspections to check the quality or quantity of the work or that the Architect has reviewed the construction means, methods, techniques, sequences, or proceedings or that the Architect has made any examination to ascertain how or for what purpose the Contractor has used the monies previously paid on account of the Contract Sum.

Section 12.02 – Stored Materials & Equipment

A. The Contractor may submit, no more than thirty (30) calendar days after contract approval and prior to the first application for payment, a written request to Cornell University for permission to invoice for critical materials and equipment ready, but not yet incorporated into the work. For the purpose of this paragraph, "critical materials and equipment" eligible for payment are defined as those items affecting project schedule or budget as determined by Cornell University's evaluation of the project schedule. This includes finished goods normally shipped to the job site in a condition ready for incorporation into the work that require significant time for delivery. Raw materials or work-in-process at a manufacturer's plant location shall not be eligible for such consideration unless the Contractor can demonstrate that Cornell University can save money by purchasing material in bulk quantities at the beginning of the project.

B. Cornell University will be under no obligation to accept such requests.

C. Payment authorized by Cornell University for such "long-lead" critical materials and equipment not yet incorporated in the work will be made provided the Contractor submits Exhibit F and complies with the following:

1. Items shall be listed in the “Total Materials Presently Stored” column on the Application for Payment.

2. Transfer of Title shall be executed and included in the Application for Payment.

3. The method used to store off-site items shall be described in the Contractor's request to invoice for such materials and equipment. Cornell University shall give prior approval of the location of off-site storage. Items requiring special environmental conditions to protect their integrity (temperature, humidity, etc.) shall be continuously stored in such an environment.

4. Items in storage shall be identified as property of Cornell University, and a description of the identification method used shall be submitted in the Application for Payment. Contractor shall maintain all necessary insurance on items in storage.

5. A written and photographic inventory of items and method used to verify such inventory, including Contractor's certification that all quantities have been received in good condition at the job site or other location acceptable to Cornell University shall be submitted with the Application for Payment.

6. A copy of the vendor's invoice is included with the Contractor's invoice. Packing lists will not be accepted.

D. Cornell University retains the right to verify storage by physical inspection prior to payment approval and at any time thereafter. Such payment shall not relieve the Contractor of the responsibility for protecting, safeguarding, and properly installing the equipment or materials. The Warranty and Guarantee period shall not commence until installation and final acceptance of the completed work by Cornell University. The Contractor shall bear the cost of transporting materials stored off-site to the site

E. Each subsequent invoice will restate the prior months' materials and equipment not incorporated in the Work and current month additions and deletions for materials and equipment incorporated into the Work.

F. Upon the making of partial payment by Cornell University, all work, materials, and equipment covered thereby shall become the sole property of Cornell University. Partial payments, however, shall not constitute acceptance of the Contractor's work by Cornell University, nor be construed as a waiver of any right or claim by Cornell University.

Section 12.03 – Retention

A. Retention in the amount of five percent (5%) of the value of the work done and materials furnished and installed under this Agreement shall be retained by the Owner as part security for the faithful performance of the Contractor’s work within the time specified, and shall be paid as indicated in Section 12.06.

B. Cornell University in its sole discretion may, upon the Contractor's application thereof, release retention applicable to a subcontractor, provided that there are no outstanding claims associated with the subcontractor's work and the subcontractor and Contractor submit an acceptable partial or final release when submitting the payment application process. A Consent of Surety to the reduction must be attached as well.

Section 12.04 - Withholding Payments

A. The Owner may, on account of subsequently discovered evidence, withhold or nullify the whole or a part of any Certificate to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective work not remedied.

2. To assure payment of just claims of any persons supplying labor or materials for the work and to discharge any lien filed against the Owner's property.

3. A reasonable doubt that the Contract can be completed for the balance of the Contract Price then unpaid.

4. Damage to another Contractor.

5. Unsatisfactory prosecution of the work by the Contractor.

6. Failure to provide and maintain an acceptable Critical Path Method Network Schedule.

Section 12.05 – Documents and Conditions Precedent to Final Payment

A. As-Built Documentation

1. Prior to acceptance by the Owner of all work covered by the Contract, the Contractor shall furnish to the Owner through the Architect one (1) set of current reproducible full-size Contract Drawings on which the Contractor has recorded in a neat and workmanlike manner all instances where actual field construction differs from work as indicated on the Contract Drawings.

B. Final Documentation:

1. Prior to final payment, and before the issuance of a final certificate for payment in accordance with the provisions of these General Conditions, file the following documents with the Owner.

a. Warranties, Bonds, Service & Maintenance Contracts and any other extended guarantees stated in the technical sections of the Specifications.

b. Release or Waiver of Lien for the Contractor and Sub-Contractors in accordance with Exhibit B, attached hereto.

c. Project Record Documents as defined in General Requirements Section 01 78 39.

d. Notification that Final Punch List work has been completed.

e. Manufacturers Instruction and Maintenance Manuals as defined in General Requirements Section 01 78 23.

f. Fixed Equipment Inventory as defined in General Requirements Section 01 78 22.

2. The Contractor shall also provide a CD containing scanned .pdf format and/or Word Documents of all documentation.

Section 12.06 - Final Payment and Release

A. When the Contractor determines that the work or a designated portion thereof is substantially complete, the Contractor shall prepare for submission to the Owner a list of items to be completed or corrected. This list, prepared by the Contractor, shall constitute a complete detailed list of defects and deficiencies which, when remedied, will complete all Contract requirements. The submittal shall be accompanied by a statement to that effect.

B. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all work in accordance with the Contract Documents. When the Architect, on the basis of an inspection, determines that the work is substantially complete, the Architect will then prepare a Certificate of Substantial Completion.

C. Upon receipt of written notice that the work is ready for final inspection and acceptance, the Architect will promptly make such inspection and, when the Architect finds the work acceptable under the provisions of the Contract Documents, and the Contract fully performed, and if bonds have been required, the written Consent of the Surety to the payment of the balance due, and a satisfactory Release of Lien, attached hereto as Exhibit "B" and made a part of the Contract Documents, has been submitted by the Contractor, each subcontractor and sub-subcontractor, the Contractor will promptly issue a final Certificate for Payment, stating that to the best of their knowledge, information, and belief, and on the basis of their observations and inspections the work has been completed in accordance with the terms and conditions of the Contract Documents, and that the entire balance is due and payable.

D. All prior certificates upon which progress payments may have been made, being estimates, shall be subject to correction to the final certificate.

E. The acceptance by the Contractor of the final payment aforesaid shall constitute a general release of the Owner and its agents or representatives from all claims and liability to the Contractor.

ARTICLE 13 -- TAX EXEMPTION

Section 13.01 - Tax Exemption

A. The Owner is exempt from payment of Federal, State and local taxes, including sales and compensating use taxes on all materials and supplies incorporated into the completed Work. These taxes are not to be included in bids. This exemption does not apply to tools, machinery, equipment or other property leased by or to the Contractor or a Subcontractor, or to supplies and materials which, even though they are consumed, are not incorporated into the completed Work, and the Contractor and Subcontractors shall be responsible for and pay any and all applicable taxes, including sales and compensating use taxes, on said leased tools, machinery, equipment or other property and upon all said unincorporated supplies and materials.

B. The Contractor and Subcontractor shall obtain any and all necessary certificates or other documentation from the appropriate governmental agency or agencies, and use said certificates or other documentation as required by law, rule or regulation.

ARTICLE 14 -- GUARANTEE

Section 14.01 - Guarantee

A. The Contractor, at the convenience of the Owner, shall remove, replace and/or repair at their own costs and expense any defects in workmanship, materials, ratings, capacities or characteristics occurring in or to the work covered by Contract for the period of one (1) year or within such longer period as may otherwise be provided in the Contract, the period of such guarantee to commence with the Owner's final acceptance of all work covered under the Contract, and the Contractor, upon demand, shall pay for all damage to all other work resulting from such defects and all expenses necessary to remove, replace and/or repair such work which may be damaged in removing, replacing or repairing the said defects. Acceptance means final acceptance of the entire work, early partial occupancy notwithstanding

B. In some instances the nature of the work may require the Owner to accept various components, equipment, spaces or phase of the project. In such cases the Contractor shall submit a separate guarantee for the Owner's acceptance on the form attached hereto as Exhibit "C". Upon completion of the project, the Contractor shall submit to the Owner a guarantee for the project on the form attached hereto as Exhibit "C".

ARTICLE 15 -- STANDARD PROVISIONS

Section 15.01 - Provisions Required by Law Deemed Inserted

Each and every provision of law or clause required by law to be inserted in the Contract, including, but not limited to, the provisions set forth in Schedule "A", attached hereto as Exhibit H and made a part hereof, shall be deemed to be inserted herein and, in the event any such provision is not inserted or is not correctly inserted, then upon the application of either party, this Contract shall forthwith be physically amended to make such insertion or correction.

Section 15.02 – Vendor Responsibility Form

The State of New York requires each Contracting Agency conduct a review of prospective contractors ("vendors") to provide reasonable assurances that the vendor is responsible. Acting as agent for the State University of New York, Cornell University is required to collect this information. This questionnaire, attached hereto as Exhibit I, is designed to provide information to assess a vendor's authorization to do business in New York State, as well as business integrity, financial and organizational capacity, and performance history. The Contractor shall complete and return this form with their executed Agreement.

Section 15.03 - Laws Governing the Contract

The Contractor shall not assign the Contract in whole or in part without prior written consent of the Owner.

Section 15.04 - Assignments

The Contractor shall not assign the Contract in whole or in part without prior written consent of the Owner.

Section 15.05 - No Third Party Rights

Nothing in the Contract shall create or shall give to third parties any claim or right of action against the Owner, beyond such rights as may legally exist irrespective of the Contract.

Section 15.06 - Waiver of Rights of Owner

A. None of the provisions of the Contract will be considered waived by the Owner except when such waiver is given in writing.

Section 15.07 - Limitation on Actions

No action or proceeding shall be filed or shall be maintained by the Contractor against the Owner unless said action shall be commenced within six (6) months after receipt by the Owner of the Contractor's final requisition or, if the Contract is terminated by the Owner, unless said action is commenced within six (6) months after the date of said termination.

Section 15.08 - Owner's Representative

The Owner shall designate a representative authorized to act in its behalf with respect to the Project. The Owner or its representative shall examine documents and shall render approvals and decisions pertaining thereto promptly, to avoid unreasonable delay in the progress of the Contractor's work. Only directives from Cornell University's designated representative (Alex Chevallard) shall be recognized by the Contractor.

Section 15.09 - Cost Escalation / De-escalation

A. The Contract Pricing for all materials, supplies and services will remain firm for the duration of the Contract. Only properly documented and timely advanced notice requests for an actual cost increase in excess of 10% for the subject materials due to a tariff tax imposed that result in significant and actual cost impacts after the date of Bid Proposal will be entertained.

B. A proper request for a cost escalation will:

1. only be considered for advanced, timely noticed, and properly documented materials escalation due to tariffs or natural disasters through no fault of the Contractor; and

2. must be submitted within thirty (30) days of actual tariff related cost escalation exceeding a total cost increase of 10% or more of the commodity's documented bid pricing; and

3. must be approved by the Owner and allowed only on a shared impact at actual pass-through cost basis, absent any mark-ups.

C. Approval of a cost escalation request will be at the sole discretion of the Owner on a shared cost basis. Retroactive cost increase adjustments will not be considered, nor will increases unrelated to tariff taxes. Adjustments to pricing shall be the result of increases at the manufacturer's level pricing incurred after the Contract commencement date that:

1. will not yield a higher profit margin than that reflected in the costs awarded in the original proposal; and

2. clearly identifies the items impacted by the increase; and

3. is accompanied by sufficient documentation, acceptable to the Owner, and subject to audit requirements below.

D. Contractor will be required to provide sufficient documentation to justify the requested cost escalations(s), and Owner will determine the acceptability of documentation and sources. Documentation will include a cost proposal in sufficient detail for the Owner to perform a cost/price analysis upon which the original proposal was made. An evaluation and/or audit will be performed on the cost proposal, as well as other submitted documentation in order to determine if the requested cost increase is a fair and reasonable reflection of the actual material cost increase(s).

E. In addition to the General Conditions Article 17 surrounding Accounting, Inspection and Audit requirements, the Contractor agrees to maintain and retain books and records showing all relevant and original costs included in Contractor bids surrounding the materials and pricing in the asserted cost escalation, as well records satisfactorily demonstrating the actual cost(s) incurred for the subject materials that are asserted to be the result of tariff impacts. Each Sub-Contractor shall be similarly obligated to maintain, for inspection and audit by the Owner, books and records respecting the relevant materials and their original pricing, as well as the subsequent actual cost(s). If requested by the Owner, the Contractor shall furnish copies of any and all relevant documents, subcontracts, purchase orders and/or requisitions of any nature associated with the project and the impacts due to tariffs. The absence of sufficient documentation shall be grounds to deny any claimed escalation in pricing due to tariffs.

F. If the Owner does not find the documentation sufficient to support a cost escalation request on a pass-through basis the Owner reserves the option to counter-offer. When agreed upon by both Parties, the contract cost changes shall be binding on the Contractor. This escalation/de-escalation provision shall apply equally to cost decreases as well as increases. Cost decreases may be considered and implemented at any time during the term of the Contract.

G. All cost escalations/de-escalations shall be processed via a Change Order to the Contract.

ARTICLE 16 – MINORITY AND WOMEN BUSINESS ENTERPRISES AND SERVICE DISABLED VETERAN OWNED BUSINESSES

Section 16.01 – Definitions

The terms "Minority-owned business enterprise" ("MBE") or “Women-owned business enterprise” (“WBE”) or “minority group member” shall have the same meaning as under Section 310 of the New York State Executive Law, as the same may be from time to time amended.

The Term “Service Disabled Veteran Owned Business” (“SDVOB”) shall have the same meaning as under NYS Executive Law Article 17-B and 9 NYCRR Part 252.

Section 16.02 – Participation by Minority and Women Business Enterprises and Service Disabled Veteran Owned Businesses.

A. The Contractor shall, in addition to any other nondiscrimination provision of the Contract and at no additional cost to Owner, fully comply and cooperate with the Owner in the implementation of MBE, WBE and SDVOB goals. These requirements include equal employment opportunities for minority group members and women (“EEO”) and contracting opportunities for certified MWBEs and SDVOBs. The Contractor’s demonstration of “good faith efforts” shall be a part of these requirements. These provisions shall be deemed supplementary to, and not in lieu of, the nondiscrimination provisions required by New York State or other applicable federal, state or local laws.

B. The Contractor shall include the provisions of this Article in each and every Agreement and/or Contract in such a manner that the provisions of this Article will be binding upon each subcontractor and supplier as to work in connection with and related to this Agreement.

C. For purposes of this procurement, the Owner has established goals as outlined in the Bid Form for Minority-Owned Business Enterprises ("MBE") and Women-Owned Business Enterprises ("WBE") participation.

1. The goal for Minority-Owned Business Enterprise participation shall be applied as follows: a maximum of one third (1/3) of the goal may be applied to purchases of materials, supplies, and equipment from MBEs.

2. The goal for Women-Owned Business Enterprise participation shall be applied as follows: a maximum of one third (1/3) of the goal may be applied to purchases of materials, supplies, and equipment from WBEs.

3. The goal for Service Disabled Veteran Owned Businesses ("SDVOB") participation shall be applied as follows: a maximum of one-third (1/3) of the goal may be applied to purchases of materials, supplies, and equipment from SDVOBs.

D. For purposes of providing meaningful participation by MWBEs and SDVOBs on the Contract and achieving the Contract Goals established in paragraph C above, the Contractor should reference the Directory of New York State Certified MWBEs and SDVOBs found at the following internet address: http://www.esd.ny.gov/mwbe.html and https://ogs.ny.gov/Core/docs/CertifiedNYS_SDVOB.pdf

E. Where MWBE and SDVOB goals have been established herein, the Contractor must document "good faith efforts" to provide meaningful participation by MWBEs and SDVOBs as sub-contractors or suppliers in the performance of the Contract.

F. Where it appears that a Contractor is unable to comply with the MWBE or SDVOB participation requirements, Contractor may submit in writing for the Owner's consideration, the reasons for Contractor's inability to meet any or all of the participation requirements together with an explanation of the efforts taken by the Contractor to obtain the stated MWBE and SDVOB participation.

Section 16.03 MWBE and SDVOB Utilization Plan

A. The Contractor shall submit a MBE/WBE/SDVOB Utilization Plan for the Owner's review prior within fifteen (15) calendar days after receipt of a Letter of Intent or Notice to Proceed.

B. The Contractor shall use such Owner approved MBE/WBE/SDVOB Utilization Plan for the performance of MWBEs and SDVOBs on the Contract pursuant to the prescribed MWBE goals established in Article 16 hereof. The Contractor shall designate a Compliance Officer in their organization who shall be responsible for implementing the MBE/WBE/SDVOB Utilization Plan of the Contractor and its subcontractors. Said Compliance Officer shall make such periodic, but not less than monthly, reports on the Plans' progress and on the number of women and minority workers employed. These reports shall be submitted to the Owner Representative on the Affirmative Action Workforce Report attached hereto as Exhibit "D".

Section 16.04 Reports and Records

A. The following forms, attached hereto as Exhibit "D" and made a part of the Contract Documents, are to be used in submitting MBE/WBE/SDVOB Utilization Plans. Electronic versions are available in the Electronic project management system Resources Project or at https://fcs.cornell.edu/project-contractors-and-consultants.

1. MWBE/SDVOB Utilization Plan
2. Workforce Report

B. The Contractor shall provide a single monthly report inclusive of all subcontractor information for the project labor and such report must document the progress made towards achievement of the MWBE and SDVOB goals of the Contract. Such forms shall be uploaded monthly to the electronic project management system.

C. The Contractor shall permit access to its books, records and accounts by the Owner for purposes of investigation to ascertain compliance with the provisions of this Article. The Contractor shall include this provision in every subcontract so that such provision will be binding upon each subcontractor.

ARTICLE 17 -- ACCOUNTINGS, INSPECTION AND AUDIT

The Contractor agrees to keep books and records showing the actual costs incurred for the Work. Such books and records (including, without limitation, any electronic data processing files used by the Contractor in analyzing and recording the Work) shall be open for inspection and audit by the Owner and its authorized representatives at reasonable hours at the Contractor's local office or at the Owner's office, if necessary, and shall be retained by the Contractor for a period of seven years after the Work has been completed, except that if any litigation, claim or audit is started before the expiration date of the seven year period, the records shall be retained until all litigation, claims or audit findings involving the records have been resolved.. Each Sub-Contractor shall be similarly obligated to maintain, for inspection and audit by the Owner, books and records respecting the Work. If requested by the Owner, the Contractor shall furnish copies of any and all subcontracts, purchase orders and/or requisitions of any nature associated with the project.

ARTICLE 18 – CONTRACTOR PERFORMANCE EVALUATION

At project completion the Owner shall schedule a meeting to review with the Contractor their performance for the project unless performance warrants additional reviews. The Owner may schedule a meeting at fifty percent (50% completion) based on project complexity and/or duration. The Owner shall present its review based on the attached “Contractor Performance Evaluation”, Exhibit G. The Contractor shall be given the opportunity to provide input as to the findings of the evaluation after completion by the Owner.

ARTICLE 19 -- ROYALTIES AND PATENTS

The Contractor shall pay all royalties and license fees and shall defend all suits or claims for infringement of any patents, and shall save Cornell University harmless from loss on account thereof; except that Cornell University shall be responsible for all such loss when a particular process or product is specified by Cornell University unless the Contractor shall have reason to believe that the particular process or product infringes a patent, in which event it shall be responsible for loss on account thereof unless it promptly provides such information to Cornell University.

ARTICLE 20 -- CONFIDENTIALITY AND USE OF OWNER'S NAME

Section 20.01 - Release of Information

The Contractor shall not divulge information concerning the Work (including news releases, social media, internal house organizations, applications for permits, etc.) to anyone without Cornell University's prior written approval, except to subcontractors and suppliers to the extent that they need such information to perform their work. The Contractor shall require a similar agreement from each such subcontractor and supplier, requiring their compliance with the foregoing. Cornell University reserves the right to release all information, as well as to time its release and specify its form and content. The Contractor may obtain Cornell University's approval to release information by submitting such request to the Cornell University Project Manager.

Section 20.02 - Confidential Information

The term "Confidential Information" means all unpublished information obtained or received from Cornell University during the term of this Contract which relates to Cornell University's research, development, manufacturing and business affairs. The Contractor shall not disclose confidential information to any person, except to its employees and subcontractors to the extent that they require it in the performance of their Work, during the term of this Contract and until authorized by Cornell University in writing. The Contractor and its subcontractors shall hold all confidential information in trust and confidence for Cornell University, and shall use confidential information only for the purpose of this Contract. The Contractor and its subcontractors shall require all of their employees to whom confidential information is revealed to comply with these provisions. The Contractor shall have an agreement with each subcontractor, requiring their compliance with the foregoing. If it becomes necessary for the Contractor to defend in case of litigation related to its services rendered, permission shall be sought from Cornell University, who shall not unreasonably withhold such permission, before any disclosures are made. This Section does not apply to information which (1) is or becomes known in public domain or (2) is learned by the Contractor from third parties.

Section 20.03 - Use of Owner's Name

The Contractor shall not use, in its external, advertising, marketing program, social media, or other promotional efforts, any date, pictures, or other representation of the Owner except on the specific written authorization in advance of the Owner's Representative.

ARTICLE 21 -- CORNELL UNIVERSITY STANDARDS OF ETHICAL CONDUCT

Cornell University expects all executive officers, trustees, faculty, staff, student employees, and others, when acting on behalf of the university, to maintain the highest standard of ethical conduct as per Cornell University's Policy 4.6 - Standards of Ethical Conduct, a copy of which is available at https://fcs.cornell.edu/project-contractors-and-consultants This includes treating equally all persons and firms currently doing business with or seeking to do business with or for Cornell University, whether as contractors, subcontractors, or suppliers. Such persons and firms are respectfully reminded that Cornell University employees and their families may not personally benefit from Cornell University's business relationships by the acceptance of gifts or gratuities, defined as a gift in excess of $75.00 given to a Cornell employee for personal use. Items not considered gifts/gratuities include occasional business meals, items of an advertising nature, and items that are generally distributed to all potential customers. In addition, it is expected that the Contractor's officers and employees shall conduct all business related to this Contract within the highest ethical standards, observing applicable policies, practices, regulations, law, and professional standards. All parties are expected to report violations of this policy to appropriate university personnel. You may file a report to on the web https://secure.ethicspoint.com/domain/en/report_custom.asp?clientid=6357 or contact Cornell University through EthicsPoint by dialing toll-free 1-866-293-3077.

Section 21.01 Private Job Site

Cornell University, its campuses and construction job sites, are private property, owned and operated by a private university. Cornell requires its Contractors, their employees and subcontractors, to conduct job sites under their project control in a professional manner free of discrimination, harassment, and intimidation.

As a private university, Cornell University job sites are neither a public nor quasi-public forums. The Contractor, subcontractors, and their respective employees and visitors to the job sites have no expectation to rights of free expression while working on a Cornell job site, surrounding campus property, or its buildings and grounds. This practice is a content neutral, non-discriminatory, and represents time, place, and manner restrictions of a private employer. A Cornell construction job site is not an appropriate venue for the exercise of personal speech or expression, political or apolitical, offensive or inoffensive, or whether made on an individual’s own time. Actions involving flags, posters, shirts, emblems, symbols, protests, messaging and the like are not permitted on the job site and the Contractor controlling the job site shall ensure its subcontractors, all workers, suppliers and visitors to the job site comply with the foregoing. Violations may result in removal from the job site for those responsible.

CORNELL UNIVERSITY

Construction Contract Change Order Forms
Instructions to Change Order Documentation

Cornell University has several standard forms related to Changes in the Work. These forms have been prepared to comply with contract requirements related to Changes in the Work. The standard Construction Contract Change Order Request and Change Order Summary Forms shall be used to facilitate preparation of change order requests in conformity with construction contract requirements.

These forms shall be used by the Contractor and by all Subcontractors in preparing their respective cost estimates for services associated with the Changed Work for the Owner's consideration and shall include all associated back-up documentation supporting the request.

Direct Cost of the Work:

1. Direct Labor – Include the "wages paid" hourly direct labor and/or foreman necessary to perform the required change. "Wages paid" is the burdened labor rate documented in accordance with Section 2.14 – Project Labor Rates of the General Conditions. "Assigned Personnel or Work Crews" should be stated by trade or type of work performed not by name of person or company title. For example carpenter, mason, backhoe operator, etc. Supervisory personnel in district or home office shall not be included. Supervisory personnel on the job-site, but with broad supervisory responsibility and paid as salaried personnel, shall not be included as Direct Labor

2. Direct Material – Include the acquisition cost of all materials directly required to perform the required change. Examples of "Unit of Measure" include square feet, cubic yards, linear feet, days, gallons, etc.

3. Equipment – Include the rental cost of equipment items necessary to perform the change. For company-owned equipment items, include documentation of internal rental rates. Charges for small tools, and craft specific tools are not allowed.

Bond Premiums

The Contractor's actual documented bond premium rate as stated on their Bid Form at time of bid shall be added to all direct and indirect costs of the proposed change.

Overhead & Profit

The Contractor's overhead & profit rate shall be added to all direct and indirect costs of the proposed change in accordance with the Contract.

EXHIBIT "A"

CONSTRUCTION CONTRACT CHANGE ORDER REQUEST

DATE: _____ **COR #** _____

PROJECT TITLE: **CONTRACT NO.** _____

❑ Name of Contractor/Subcontractor performing Work: _____

DESCRIPTION OF WORK: _____

_____

_____

A. DIRECT COST OF WORK:

1	**LABOR** (Attach Supporting Documentation) **ASSIGNED PERSONNEL OR WORK CREW**	**HOURLY WAGE RATE PAID**	**HOURS WORKED**	**TOTAL COST**
	_____			$0
	_____			$0
	_____			$0
	_____			$0
			LABOR TOTAL	$0

2	**MATERIAL** (Attach Supporting Documentation) **MATERIAL REQUIRED FOR CHANGE**	**UNIT PRICE**	**UNIT OF MEASURE**	**REQUIRED UNITS**	**TOTAL COST**
	_____				$0
	_____				$0
	_____				$0
	_____				$0
				MATERIAL TOTAL	$0

3	**EQUIPMENT** (Attach Supporting Documentation) **EQUIPMENT REQUIRED FOR CHANGE**	**UNIT PRICE**	**UNIT OF MEASURE**	**REQUIRED UNITS**	**TOTAL COST**
	_____				$0
	_____				$0
	_____				$0
	_____				$0
	_____				$0
				EQUIPMENT TOTAL	$0

4	**DIRECT COST (SUM 1, 2, 3)**	$0
5	**OH&P Rate** _____	$0

6	**SUBCONTRACTOR** (Attach Supporting Documentation) **SUB-SUBCONTRACTOR REQD FOR CHANGE**	**SUB-SUB COST OF WORK**	**SUB-SUB MARK UP %**	**TOTAL COST**
	_____			$0
	_____			$0
	_____			$0
			SUB-SUBCONTRACTOR TOTAL	$0

7	**OVERHEAD AND PROFIT** **OH&P Rate** _____	$0
	TOTAL COST PLUS OH&P (SUM 4, 5, 6, 7)	$0
8	**BOND PREMIUM (If applicable)** **Bond Premium Rate** _____	$0
	TOTAL COR COST	$0
	TOTAL CONTRACT DAYS ADDED/DELETED FROM PROJECT SCHEDULE	0

EXHIBIT "A"

CONSTRUCTION CONTRACT CHANGE ORDER SUMMARY

DATE: _____

PCO # _____

PROJECT TITLE: _____ **CONTRACT NO.** _____

CONTRACTOR: _____

DETAILED DESCRIPTION OF WORK: _____

1 **DIRECT COST OF WORK:**

NAME OF CONTRACTOR/SUBCONTRACTORS PERFORMING WORK	**TOTAL COST**

TOTAL COST OF PROPOSED CHANGE ORDER ITEM $0

TOTAL CONTRACT DAYS ADDED/DELETED FROM PROJECT SCHEDULE

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EXHIBIT "B"

FINAL RELEASE

FINAL WAIVER OF CLAIMS AND LIENS AND RELEASE OF RIGHTS

Date	_____	Contract Date	_____
Project	_____	Contract Price	_____
Address	_____	Net Extras and Deductions	_____
City	_____	Adjusted Contract Price	_____
County	_____	Amount Previously Paid	_____
State	_____	Balance Due - Final Payment	_____

The undersigned hereby acknowledges that the above Balance Due when paid represents payment in full for all labor, materials, etc., furnished by the below named Contractor or Supplier in connection with its work on the above Project in accordance with the Contract.

In consideration of the amounts and sums previously received, and the payment of $_____ being the full and Final Payment amount due, the below named Contractor or Supplier does hereby waive and release the Owner from any and all claims and liens and rights of liens upon the premises described above, and upon improvements now or hereafter thereon, and upon the monies or other considerations due or to become due from the Owner or from any other person, firm or corporation, said claims, liens and rights of liens being on account of labor, services, materials, fixtures or apparatus heretofore furnished by the below named Contractor or Supplier to the Project. The premises as to which said claims and liens are hereby released are identified as follows:_____ _____.

The undersigned further represents and warrants that he/she is duly authorized and empowered to sign and execute this waiver on his/her own behalf and on behalf of the company or business for which he/she is signing; that it has properly performed all work and furnished all materials of the specified quality per plans and specifications and in a good and workmanlike manner, fully and completely; that it has paid for all the labor, materials, equipment and services that it has used or supplied, that it has no other outstanding and unpaid applications, invoices, retentions, holdbacks, expenses employed in the prosecution of work, chargebacks or unbilled work or materials against the Owner as of the date of the aforementioned last and final payment application; and that any materials which have been supplied or incorporated into the above premises were either taken from its fully-paid or open stock or were fully paid for and supplied on the last and final payment application or invoice.

The undersigned further agrees to defend, indemnify and hold harmless the Owner for any losses or expenses (including without limitation reasonable attorneys' fees) should any such claim, lien or right of lien be asserted by the below named Contractor or Supplier or by any of its or their laborers, material persons or subcontractors.

I

n addition, for and in consideration of the amounts and sums received, the below named Contractor or Supplier hereby waives, releases and relinquishes any and all claims, rights or causes of action in equity or law whatsoever arising out of through or under the above mentioned Contract and the performance of work pursuant thereto.

The below named Contractor or Supplier further guarantees that all portions of the work furnished and installed are in accordance with the Contract and that the terms of the Contract with respect to this guarantee will remain in effect for the period specified in said Contract.

Sworn to before me this

_____ Day of _____ 20__

_____

_____
Corporation or Business Name

By: _____

Title: _____

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EXHIBIT "C"

GUARANTEE

Date: _____

In accordance with plans and specifications and the terms and conditions of our contract with Cornell University dated _____, we hereby guarantee the _____ as found in the specifications for _____, Ithaca, New York to be free
(Project Title)
from defects in materials and workmanship for the period of _____ year(s) from _____, the date of acceptance by the Owner.
(Date)

_____
(COMPANY)

By: _____

Title: _____

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MWBE/SDVOB Utilization Plan

Project No. _____ Bid Date: Click here to enter a date. Agreement/Contract Value: _____

Contractor: _____ Primary Contact: _____

Address: _____ City: _____ State: _____ Zip Code: _____

Phone Number: _____ Fax Number: _____ E-Mail: _____

GOALS: **MBE** 4.30% **WBE** 3.34% **SDVOB** 6.00% **Campus:** _____

SUBCONTRACTOR	FEDERAL ID #	DOLLAR VALUE OF CONTRACT OR PURCHASE ORDER	DESCRIPTION OF WORK OR SUPPLIES	SUBCONTRACTOR/SUPPLIER SCHEDULE	
				START DATE	COMPLETION DATE
Company Name: _____ **Street Address:** _____ **Contact Name:** _____ **E-Mail Address:** _____ **Check One:** MBE ☐ WBE ☐ SDVOB ☐				Click here to enter a date.	Click here to enter a date.
Company Name: _____ **Street Address:** _____ **Contact Name:** _____ **E-Mail Address:** _____ **Check One:** MBE ☐ WBE ☐ SDVOB ☐				Click here to enter a date.	Click here to enter a date.
Company Name: _____ **Street Address:** _____ **Contact Name:** _____ **E-Mail Address:** _____ **Check One:** MBE ☐ WBE ☐ SDVOB ☐				Click here to enter a date.	Click here to enter a date.
Company Name: _____ **Street Address:** _____ **Contact Name:** _____ **E-Mail Address:** _____ **Check One:** MBE ☐ WBE ☐ SDVOB ☐				Click here to enter a date.	Click here to enter a date.

In accordance with the SUNY Contract Documents and Executive Law Article 15-A, my firm seriously expects to use the NYS certified MBE/WBE certified firms listed above. The Contractor shall immediately notify and request approval prior to any changes to this plan from the University-wide MWBE Program Office.

NAME: _____ TITLE: _____ COMPANY OFFICER'S SIGNATURE _____ DATE: Click here to enter a date.

APPROVED:☐ DEFICIENT:☐ MWBE PROGRAM COORDINATOR: _____ DATE:_____

MWBE/SDVOB Utilization Plan

PART III – Quarterly Utilization Report *(Subcontractors & Sub-subcontractors fill this out and submit to General Contractor to compile into a single form.)* Double click on table to edit.

Month/Year:

General Contractor, Subcontractor, Sub-Subcontractor, or Vendor	Trade	Dollar Value of SubContract or Purchase Order	MBE/WBE SDVOB, or N/A	% of Total Contract
TOTALS		0		0

EXHIBIT "D" - FORM II

SUMMARY OF BID ACTIVITY WITH MBE, WBE AND SDVOB SUBCONTRACTORS AND VENDORS

Please print or type <u>all</u> information, except where a signature is required.

PROJECT: _____

Name of Prime Contract Bidder:

_____

Address (Street, City, State and Zip Code):

_____

Contact Person (Name, Title and Telephone Number):

_____

MBE, WBE and SDVOB Subcontractor/Vendor (Indicate which)	Trade	Item/ Date	Bid Submitted: Amount	Bid Submitted: Date	Award Status Amount	Date of Elimination

EXPLANATION OF ELIMINATION: Include meetings held for negotiation, etc.
(Use additional sheet if necessary)

OFFICER OF FIRM:

Name and Title: _____ Date: _____

Signature: _____

EXHIBIT "D" - FORM III

CORNELL UNIVERSITY

Please print or type all information.

PROJECT

PRIME CONTRACTOR

WORKFORCE REPORT

For the period of _____
(Month/Year)

Prime Contractor, Subcontractor and Sub-Subcontractor's Name	Craft and/or Trade	Total of All Employee Hours By Trade	Non-Hispanic / Caucasian		Black		Hispanic		Asian / Pacific Islander		American Indian / Alaskan Native		Minority Employee Hours as a Percentage of Total Employee Hours	Total Number of Employees		Total Number of Minority Employees	
			Hours Male	Hours Female	Hours Male	Hours Female	Hours Male	Hours Female	Hours Male	Hours Female	Hours Male	Hours Female		Male	Female	Male	Female
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MONTHLY PROJECT TOTALS		0	0	0	0	0	0	0	0	0	0	0	#DIV/0!	0	0	0	0

NOTE: The Prime Contractor shall provide a single monthly report inclusive of all subcontractor information for the project.

EXHIBIT “"E"

LABOR RATE BREAKDOWN

PROJECT TITLE: _____ **CONTRACT NO.** _____

CONTRACTOR: _____ **TRADE:** _____

EFFECTIVE DATE: _____
EXPIRATION DATE: _____

Base Hourly Rate: $ _____

Payroll Taxes and Insurance	**% per Hour**
F.I.C.A.	
Federal Unemployment *(Base on 1500 hours of work)*	
State Unemployment *(Base on 1500 hours of work)*	
* Worker's Compensation	
* Bodity Injury & Property Damage	
Disability	
TOTAL	%

Payroll Taxes and Insurance Rates: Base Rate (x) Total % = $ _____

* Rates are net Contractor cost after premium discounts and experience modifications have been applied against manual rate.

Supplemental Benefits	**$ per Hour**
Vacation	
Health & Welfare	
Pension	
Annuity	
Education / Training	
Industry	

Total Hourly Fringe Benefits $ _____

Hourly Labor Rate: Base Rate, Taxes/Insurance and Fringe Benefits $ _____

Adjustment for a composite rate which includes apprentices: $ _____

CONTRACTOR'S CERTIFICATION

I certify that the labor rates, insurance enumerations, labor fringe enumerations and expenses are correct and in accordance with actual and true cost incurred.

Signature of Authorized Representative:

_____

Print Name: _____

Print Title: _____

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EXHIBIT "F"

STORED MATERIALS INVOICING DOCUMENTATION

PROJECT TITLE:

_____

CONTRACT NO.

CONTRACTOR: _____ **SUBCONTRACTOR:** _____ _____

REASON FOR REQUEST: _____

_____

_____

APPLICATION FOR PAYMENT NO. _____ **DATE:** _____

_____

1 **Material Identification**

Description:

_____

_____ Quantity:

_____ _____

_____ _____

_____ _____

_____ _____

Provide Specific Location of Materials Stored: _____ _____

_____

_____

_____

_____

2 **Material Value**

☐ Attach an Invoice or Quantified Statement of Value. $ _____

3 **Certificate of Insurance**

☐ Attach a Certificate of Insurance for the above specified materials. Certificate shall name "Cornell University" as a loss payee with respect to the specified materials.

4 **Transfer of Title**

The Contractor hereby agrees to transfer complete ownership of all listed materials to Cornell University at the time payment is made to Contractor for the above referenced Application for Payment. The Contractor remains responsible for all contractual requirements for the above listed materials including complete installation and providing of all warranties.

Signed:

_____

Date:

_____

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EXHIBIT "G"

Cornell University

Contractor Performance Evaluation

Project Information

Project Name:_____ Date Of Evaluation_____

Project Number_____ Evaluators;

Project Team_____

Campus_____

Project Start Date_____ Substantial Completion_____

Contractor_____ Prequalification Status_____

Original Contract Amount_____ Total Change Order Amount_____

Contractor Project Manager_____ Initial Evaluation_____

Contractor Superintendent_____ Final Evaluation_____

Type Of Contract

Prime Contractor___ Subcontractor___ Construction Manager___

Project Comments/Description

Performance Evaluation

Please give one rating for each category. Add comments as required to justify your rating.

Fails to Achieve Expectation	Needs Improvement	Fully Achieve Expectation	Freq Exceeds Expectation	Cons Exceed Expectation
1	2	3	4	5

1 Quality of Workmanship

Rate this contractor's performance in regards to quality of work

- **a.** Compliance with project drawings and specifications
- **b.** Workmanship quality and accuracy
- **c.** Tools- quality and sufficient quantity
- **d.** Equipment - sufficient quantity and operating condition
- **e.** Quality of jobsite craft personnel

Comments:

2 Scheduling/Productivity

Rate this contractor's performance with regard to producing and meeting contract schedules and milestones

- **a.** Project schedule quality and completeness
- **b.** Controlling of project schedule
- **c.** Manpower allocation for maintaining schedule
- **d.** Material deliveries to support project schedule
- **e.** Ability to meet substantial completion date and project milestones
- **f.** Productivity of work force
- **g**. Ability to deal with added work and unforeseen issues.

Comments:

3 Subcontractor Management

Rate this contractor's ability, effort and success in managing and coordinating subcontractors ***(if no subcontractors rate overall management performance)***

Comments:

3A Major subcontractor performance(score not added in final Contractor Evaluation

For contractor information only

- **a.** Plumbing Contractor overall Performance

Comments:

- **b.** HVAC Contractor overall Performance

Comments:

- **c.** Electrical Contractor overall Performance

Comments:

Fails to Achieve Expectation	Needs Improvement	Fully Achieve Expectation	Freq Exceeds Expectation	Cons Exceed Expectation
1	2	3	4	5

4 **MBE/WBE Participation**

Rate this contractor's MBE/WBE solicitation effort and participation for this project for, Project Team, Subcontractors, Material Vendors

Comments:

5 **Safety**

Rate this contractor's performance in regards to project safety

- **a.** Timely submission of site specific safety program
- **b.** Knowledge of OSHA standards
- **c.** Implementation of safety rules and regulations
- **d.** Promotion and creation of safety awareness
- **e.** Daily overall housekeeping
- **f.** Safety record
- **g.** Response to safety concerns
- **h.** Awareness of public safety

Comments:

6 **Contract Administration**

Rate this contractor's performance in regards to contract administration as per criteria below

- **a.** Timely submission of complet and correct documentation required for insurance and bond
- **b.** Change order processing
- **c.** Timely submission of RFI's, Shop Drawings, and change orders
- **d.** Subcontractor payments made promptly
- **e.** Timely submission of complete and correct payment applications
- **f.** Quality of paperwork

Comments:

7 **Working Relationships**

Rate this contractor's working relationships with other parties (Cornell, Design Team, subcontractors,ect.)

Comments:

Fails to Achieve Expectation	Needs Improvement	Fully Achieve Expectation	Freq Exceeds Expectation	Cons Exceed Expectation
1	2	3	4	5

8 **Supervisory Personnel Rating**

Rate the overall performance of this contractor's on site supervisory personnel and project management staff

Comments:

9 **Contract Close-Out**

Rate this contractor's overall ability to efficiently close out the project

a. Timely completion of all punchlist items
b. Timely resolution of all outstanding change orders
c. Timely submission of all close out documents(O&M's, As-Builts, warranties, final releases and consent of surety)
d. Quality of close out documentation and timely completion of any outstanding audit questions

Comments:

Summary Sheet

Project:_____
Contractor:_____

	Performance Categories	Rating Per Category	Weight %	Scoring
1	Quality of Workmanship	0	15.00%	0
2	Scheduling	0	10.00%	0
3	Subcontractor Management	0	10.00%	0
4	MBE/WBE Participation	0	10.00%	0
5	Safety	0	10.00%	0
6	Contract Administration	0	10.00%	0
7	Working Relationships	0	10.00%	0
8	On Site Supervisory Personnel Rating	0	18.00%	0
9	Contract Close Out	0	7.00%	0

Over All Rating 0

Rating Reference	
Fails to achieve expectation	1
Needs improvement	2
Fully achieves expectation	3
Frequently exceeds expectation	4
Consistently exceeds expectatio	5

OWNER COMMENTS:

OWNER COMMENTS on 3A Ratings:

CONTRACTOR COMMENTS:
(To be completed by Contractor prior to Owner/Contractor discussion meeting)

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Standard Contract Clauses
State University of New York

SCHEDULE A

June 21, 2023

The parties to the attached contract, license, lease, amendment or other agreement of any kind (hereinafter, "contract") agree to be bound by the following clauses which are hereby made a part of the contract (the word "Contractor" herein refers to any party other than the State or State University of New York, whether a Contractor, licensor, licensee, lessor, lessee or any other party; the State University of New York shall hereinafter be referred to as "SUNY"):

1. **EXECUTORY CLAUSE.** In accordance with Section 41 of the State Finance Law, the State shall have no liability under this contract to the Contractor or to anyone else beyond funds appropriated and available for this contract.

2. **PROHIBITION AGAINST ASSIGNMENT**. In accordance with Section 138 of the State Finance Law, this contract may not be assigned by the Contractor or its right, title or interest therein assigned, transferred, conveyed, sublet or otherwise disposed of without the State's previous written consent, and attempts to do so are null and void. Notwithstanding the foregoing, such prior written consent of an assignment of a contract let pursuant to Article XI of the State Finance Law may be waived at the discretion of SUNY and with the concurrence of the State Comptroller where the original contract was subject to the State Comptroller's approval, where the assignment is due to a reorganization, merger or consolidation of the Contractor's business entity or enterprise. SUNY retains its right to approve an assignment and to require that any Contractor demonstrate its responsibility to do business with SUNY. The Contractor may, however, assign its right to receive payments without SUNY's prior written consent unless this contract concerns Certificates of Participation pursuant to Article 5-A of the State Finance Law.

3. **COMPTROLLER'S APPROVAL.** (a) In accordance with Section 112 of the State Finance Law, the State Comptroller's approval is required for the following contracts: (i) goods, services, construction, and construction-related services for State University hospital or healthcare facilities which exceed $150,000; (ii) purchases utilizing an Office of General Services (OGS) centralized contract which exceed $200,000 (iii) goods, services, construction, and construction-related services not described in (i) or (ii) and which exceed $75,000;

(b) If this contract exceeds the threshold amounts listed above in Paragraph 3(a), or, if this is an amendment for any amount to a contract which, as so amended, exceeds said threshold amounts, or if, by this contract, the State agrees to give something other than money when the value or reasonably estimated value of such consideration exceeds $25,000, it shall not be valid, effective or binding upon the State, and the State shall bear no liability, until it has been approved by the State Comptroller and filed in his or her office.

4. **WORKERS' COMPENSATION BENEFITS.** In accordance with Section 142 of the State Finance Law, this contract shall be void and of no force and effect unless the Contractor shall provide and maintain coverage during the life of this contract for the benefit of such employees as are required to be covered by the provisions of the Workers' Compensation Law.

5. **NON-DISCRIMINATION REQUIREMENTS.** To the extent required by Article 15 of the Executive Law (also known as the Human Rights Law) and all other State and Federal statutory and constitutional non-discrimination provisions, the Contractor will not discriminate against any employee or applicant for employment, nor subject any individual to harassment, because of age, race, creed, color, national origin, citizenship or immigration status, sexual orientation, gender identity or expression, military status, sex, disability, predisposing genetic characteristics, familial status, marital status, or domestic violence victim status or because the individual has opposed any practices forbidden under the Human Rights Law or has filed a complaint, testified, or assisted in any proceeding under the Human Rights Law. Furthermore, in accordance with Section 220-e of the Labor Law, if this is a contract for the construction, alteration or repair of any public building or public work or for the manufacture, sale or distribution of materials, equipment or supplies, and to the extent that this contract shall be performed within the State of New York, Contractor agrees that neither it nor its subcontractors shall, by reason of race, creed, color, disability, sex, or national origin: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. If this is a building service contract as defined in Section 230 of the Labor Law, then, in accordance with Section 239 thereof, Contractor agrees that neither it nor its subcontractors shall by reason of race, creed, color, national origin, age, sex or disability: (a) discriminate in hiring against any New York State citizen who is qualified and available to perform the work; or (b) discriminate against or intimidate any employee hired for the performance of work under this contract. Contractor is subject to fines of $50.00 per person per day for any violation of Section 220-e or Section 239 as well as possible termination of this contract and forfeiture of all moneys due hereunder for a second or subsequent violation

6. **WAGE AND HOURS PROVISIONS.** If this is a public work contract covered by Article 8 of the Labor Law or a building service contract covered by Article 9 thereof, neither Contractor's employees nor the employees of its subcontractors may be required or permitted to work more than the number of hours or days stated in said statutes, except as otherwise provided in the Labor Law and as set forth in prevailing wage and supplement schedules issued by the State Labor Department. Furthermore, Contractor and its subcontractors must pay at least the prevailing wage rate and pay or provide the prevailing supplements, including the premium rates for overtime pay, as determined by the State Labor Department in accordance with the Labor Law. Additionally, effective April 28, 2008, if this is a public work contract covered by Article 8 of the Labor Law, the Contractor understands and agrees that the filing of payrolls in a manner consistent with Subdivision 3-a of Section 220 of the Labor Law shall be a condition precedent to payment by the State of any State--approved sums due and owing for work done upon the project.

7. **NON-COLLUSIVE BIDDING CERTIFICATION.** In accordance with Section 139-d of the State Finance Law, if this contract was awarded based upon the submission of competitive bids, Contractor affirms, under penalty of perjury, that its bid was arrived at independently and without collusion aimed at restricting competition. Contractor further affirms that, at the time Contractor submitted its bid, an authorized and responsible person executed and delivered to SUNY a non-collusive bidding certification on Contractor's behalf.

8. **INTERNATIONAL BOYCOTT PROHIBITION.** In accordance with Section 220-f of the Labor Law and Section 139-h of the State Finance Law, if this contract exceeds $5,000, the Contractor agrees, as a material condition of the contract, that neither the Contractor nor any substantially owned or affiliated person, firm, partnership or corporation has participated, is participating, or shall participate in an international boycott in violation of the federal Export Administration Act of 1979 (50 USC App. Sections 2401 *et seq*.) or regulations thereunder. If such Contractor, or any of the aforesaid affiliates of Contractor, is convicted or is otherwise found to have violated said laws or regulations upon the final determination of the United States Commerce Department or any other appropriate agency of the United States subsequent to the contract's execution, such contract, amendment or modification thereto shall be rendered forfeit and void. The Contractor shall so notify the State Comptroller within five (5) business days of such conviction, determination or disposition of appeal (2 NYCRR § 105.4).

9. **SET-OFF RIGHTS.** The State shall have all of its common law, equitable and statutory rights of set-off. These rights shall include, but not be limited to, the State 's option to withhold for the purposes of set-off any moneys due to the Contractor under this contract up to any amounts due and owing to the State with regard to this contract, any other contract with any State department or agency, including any contract for a term commencing prior to the term of this contract, plus any amounts due and owing to the State for any other reason including, without limitation, tax delinquencies, fee delinquencies or monetary penalties relative thereto. The State shall exercise its set-off rights in accordance with normal State practices including, in cases of set-off pursuant to an audit, the finalization of such audit by SUNY, its representatives, or the State Comptroller.

10. **RECORDS.** The Contractor shall establish and maintain complete and accurate books, records, documents, accounts and other evidence directly pertinent to performance under this contract (hereinafter, collectively, "the Records"). The Records must be kept for the balance of the calendar year in which they were made and for six (6) additional years thereafter. The State Comptroller, the Attorney General and any other person or entity authorized to conduct an examination, as well as SUNY and any other agencies involved in this contract, shall have access to the Records during normal business hours at an office of the Contractor within the State of New York or, if no such office is available, at a mutually agreeable and reasonable venue within the State, for the term specified above for the purposes of inspection, auditing and copying. SUNY shall take reasonable steps to protect from public disclosure any of the Records which are exempt from disclosure under Section 87 of the Public Officers Law (the "Statute") provided that: (i) the Contractor shall timely inform an appropriate SUNY official, in writing, that said Records should not be disclosed; and (ii) said Records shall be sufficiently identified; and (iii) designation of said Records as exempt under the Statute is reasonable. Nothing contained herein shall diminish, or in any way adversely affect, SUNY's or the State's right to discovery in any pending or future litigation.

11. **IDENTIFYING INFORMATION AND PRIVACY NOTIFICATION.**

(a) Identification Number(s). Every invoice or New York State Claim for Payment submitted to SUNY by a payee, for payment for the sale of goods or services or for transactions (e.g., leases, easements, licenses, etc.) related to real or personal property must include the payee's identification number. The number is any or all of the following: (i) the payee's Federal employer identification number, (ii) the payee's Federal social security number, and/or (iii) the payee's Vendor Identification Number assigned by the Statewide Financial System. Failure to include such number or numbers may delay payment. Where the payee does not have such number or numbers, the payee, on its invoice or Claim for Payment, must give the reason or reasons why the payee does not have such number or numbers.

(b) Privacy Notification. (1) The authority to request the above personal information from a seller of goods or services or a lessor of real or personal property, and the authority to maintain such information, is found in Section 5 of the State Tax Law. Disclosure of this information by the seller or lessor to SUNY or the State is mandatory. The principal purpose for which the information is collected is to enable the State to identify individuals, businesses and others who have been delinquent in filing tax returns or may have understated their tax liabilities and to generally identify persons affected by the taxes administered by the Commissioner of Taxation and Finance. The information will be used for tax administration purposes and for any other purpose authorized by law. (2) The personal information is requested by the purchasing unit of SUNY contracting to purchase the goods or services or lease the real or personal property covered by this contract or lease. The information is maintained in the Statewide Financial System by the Vendor Management Unit within the Bureau of State Expenditures, Office of the State Comptroller, 110 State Street, Albany, New York 12236.

12. **EQUAL EMPLOYMENT OPPORTUNITIES FOR MINORITIES AND WOMEN.**
In accordance with Section 312 of the Executive Law and 5 NYCRR Part 143, if this contract is: (i) a written agreement or purchase order instrument, providing for a total expenditure in excess of $25,000.00, whereby a contracting agency is committed to expend or does expend funds in return for labor, services, supplies, equipment, materials or any combination of the foregoing, to be performed for, or rendered or furnished to the contracting agency; or (ii) a written agreement in excess of $100,000.00 whereby a contracting agency is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon; or (iii) a written agreement in excess of $100,000.00 whereby the owner of a State assisted housing project is committed to expend or does expend funds for the acquisition, construction, demolition, replacement, major repair or renovation of real property and improvements thereon for such project, then the following shall apply and by signing this agreement the Contractor certifies and affirms that it is Contractor's equal employment opportunity policy that:

(a) The Contractor will not discriminate against employees or applicants for employment because of race, creed, color, national origin, sex, age, disability or marital status, shall make and document its conscientious and active efforts to employ and utilize minority group members and women its workforce on State contracts and will undertake or continue existing programs of affirmative action to ensure that minority group members and women are afforded equal employment opportunities without discrimination. Affirmative action shall mean recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff, or termination and rates of pay or other forms of compensation;

(b) at SUNY's request, Contractor shall request each employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other agreement or understanding, to furnish a written statement that such employment agency, labor union or representative will not discriminate on the basis of race, creed, color, national origin, sex, age, disability or marital status and that such union or representative will affirmatively cooperate in the implementation of the Contractor's obligations herein; and

(c) the Contractor shall state, in all solicitations or advertisements for employees, that, in the performance of the State contract, all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, color, national origin, sex, age, disability or marital status.

Contractor will include the provisions of "a," "b," and "c" above, in every subcontract over $25,000.00 for the construction, demolition, replacement, major repair, renovation, planning or design of real property and improvements thereon (the "Work") except where the Work is for the beneficial use of the Contractor. Section 312 does not apply to: (i) work, goods or services unrelated to this contract; or (ii) employment outside New York State. The State shall consider compliance by a contractor or sub-contractor with the requirements of any federal law concerning equal employment opportunity which effectuates the purpose of this clause. SUNY shall determine whether the imposition of the requirements of the provisions hereof duplicate or conflict with any such federal law and if such duplication or conflict exists, SUNY shall waive the applicability of Section 312 to the extent of such duplication or conflict. Contractor will comply with all duly promulgated and lawful rules and regulations of the Department of Economic Development's Division of Minority and Women's Business Development pertaining hereto.

13. **CONFLICTING TERMS.** In the event of a conflict between the terms of the contract (including any and all attachments thereto and amendments thereof) and the terms of this Schedule A, the terms of this Schedulet A shall control.

14. **GOVERNING LAW.** This contract shall be governed by the laws of the State of New York except where the Federal supremacy clause requires otherwise.

15. **LATE PAYMENT.** Timeliness of payment and any interest to be paid to Contractor for late payment shall be governed by Article 11-A of the State Finance Law to the extent required by law.

16. **NO ARBITRATION.** Disputes involving this contract, including the breach or alleged breach thereof, may not be submitted to binding arbitration (except where statutorily authorized) but must, instead, be heard in a court of competent jurisdiction of the State of New York.

17. **SERVICE OF PROCESS.** In addition to the methods of service allowed by the State Civil Practice Law & Rules ("CPLR"), Contractor hereby consents to service of process upon it by registered or certified mail, return receipt requested. Service hereunder shall be complete upon Contractor's actual receipt of process or upon the State's receipt of the return thereof by the United States Postal Service as refused or undeliverable. Contractor must promptly notify the State, in writing, of each and every change of address to which service of process can be made. Service by the State to the last known address shall be sufficient. Contractor will have thirty (30) calendar days after service hereunder is complete in which to respond.

18. **PROHIBITION ON PURCHASE OF TROPICAL HARDWOODS.** The Contractor certifies and warrants that all wood products to be used under this contract award will be in accordance with, but not limited to, the specifications and provisions of State Finance Law §165 (Use of Tropical Hardwoods), which prohibits purchase and use of tropical hardwoods, unless specifically exempted, by the State or any governmental agency or political subdivision or public benefit corporation. Qualification for an exemption under this law will be the responsibility of the contractor to establish to meet with the approval of the State.

In addition, when any portion of this contract involving the use of woods, whether supply or installation, is to be performed by any subcontractor, the prime Contractor will indicate and certify in the submitted bid proposal that the subcontractor has been informed and is in compliance with specifications and provisions regarding use of tropical hardwoods as detailed in Section 165 of the State Finance Law. Any such use must meet with the approval of the State, otherwise, the bid may not be considered responsive. Under bidder certifications, proof of qualification for exemption will be the responsibility of the Contractor to meet with the approval of the State.

19. **MACBRIDE FAIR EMPLOYMENT PRINCIPLES.** In accordance with the MacBride Fair Employment Principles (Chapter 807 of the Laws of 1992) , the Contractor hereby stipulates that the Contractor either (a) has no business operations in Northern Ireland, or (b) shall take lawful steps in good faith to conduct any business operations in Northern Ireland in accordance with the MacBride Fair Employment Principles (as described in Section 165of the New York State Finance Law), and shall permit independent monitoring of compliance with such principles.

20. **OMNIBUS PROCUREMENT ACT OF 1992.**
It is the policy of New York State to maximize opportunities for the participation of New York State business enterprises, including minority and women-owned business enterprises as bidders, subcontractors and suppliers on its procurement contracts.

Information on the availability of New York State subcontractors and suppliers is available from:

NYS Department of Economic Development
Division for Small Business and Technology Development
625 Broadway
Albany, NY 12245
Telephone: 518-292-5100

A directory of certified minority and women-owned business enterprises is available from:

NYS Department of Economic Development
Division of Minority and Women's Business Development
633 Third Avenue 33rd Floor
New York, NY 10017
646-846-7364
email: mwbebusinessdev@esd.ny.gov
https://ny.newnycontracts.com/FrontEnd/searchcertifieddirectory.asp

The Omnibus Procurement Act of 1992 (Chapter 844 of the Laws of 1992, codified in State Finance Law § 139-i and Public Authorities Law § 2879(3)(n)–(p)) requires that by signing this bid proposal or contract, as applicable, Contractors certify that whenever the total bid amount is greater than $1 million:

(a) The Contractor has made reasonable efforts to encourage the participation of New York State Business Enterprises as suppliers and subcontractors, including certified minority and women-owned business enterprises, on this project, and has retained the documentation of these efforts to be provided upon request to SUNY;

(b) The Contractor has complied with the Federal Equal Employment Opportunity Act of 1972 (P.L. 92-261), as amended;

(c) The Contractor agrees to make reasonable efforts to provide notification to New York State residents of employment opportunities on this project through listing any such positions with the Job Service Division of the New York State Department of Labor, or providing such notification in such manner as is consistent with existing collective bargaining contracts or agreements. The Contractor agrees to document these efforts and to provide said documentation to the State upon request; and

(d) The Contractor acknowledges notice that the State may seek to obtain offset credits from foreign countries as a result of this contract and agrees to cooperate with the State in these efforts.

21. **RECIPROCITY AND SANCTIONS PROVISIONS.** Bidders are hereby notified that if their principal place of business is located in a country, nation, province, state or political subdivision that penalizes New York State vendors, and if the goods or services they offer will be substantially produced or performed outside New York State, the Omnibus Procurement Act of 1994 and 2000 amendments (Chapter 684 and Chapter 383, respectively, codified in State Finance Law § 165(6) and Public Authorities Law § 2879(5)) require that they be denied contracts which they would otherwise obtain.
NOTE: As of May 2023, the list of discriminatory jurisdictions subject to this provision includes the states of South Carolina, Alaska, West Virginia, Wyoming, Louisiana and Hawaii.

22. **COMPLIANCE WITH BREACH NOTIFICATION AND DATA SECURITY LAWS.** Contractor shall comply with the provisions of the New York State Information Security Breach and Notification Act (General Business Law § 899-aa, § 899-bb, and State Technology Law § 208).

23. **COMPLIANCE WITH CONSULTANT DISCLOSURE LAW.** If this is a contract for consulting services, defined for purposes of this requirement to include analysis, evaluation, research, training, data processing, computer programming, engineering, environmental health and mental health services, accounting, auditing, paralegal, legal or similar services, then in accordance with Section 163(4)(g) of the State Finance Law (as amended by Chapter 10 of the Laws of 2006), the Contractor shall timely, accurately and properly comply with the requirement to submit an annual employment report for the contract to SUNY, the Department of Civil Service and the State Comptroller.

24. **PURCHASES OF APPAREL AND SPORTS EQUIPMENT**. In accordance with State Finance Law Section 165(7), SUNY may determine that a bidder on a contract for the purchase of apparel or sports equipment is not a responsible bidder as defined in State Finance Law Section 163 based on (a) the labor standards applicable to the manufacture of the apparel or sports equipment, including employee compensation, working conditions, employee rights to form unions and the use of child labor; or (b) bidder's failure to provide information sufficient for SUNY to determine the labor conditions applicable to the manufacture of the apparel or sports equipment.

25. **PROCUREMENT LOBBYING**. To the extent this contract is a "procurement contract" as defined by State Finance Law §§ 139-j and 139-k, by signing this contract the Contractor certifies

and affirms that all disclosures made in accordance with State Finance Law §§ 139-j and 139-k are complete, true and accurate. In the event such certification is found to be intentionally false or intentionally incomplete, the State may terminate the contract by providing written notification to the Contractor in accordance with the terms of the contract.

26. **CERTIFICATION OF REGISTRATION TO COLLECT SALES AND COMPENSATING USE TAX BY CERTAIN STATE CONTRACTORS, AFFILIATES AND SUBCONTRACTORS**. To the extent this contract is a contract as defined by Tax Law § 5-a, if the Contractor fails to make the certification required by Tax Law § 5-a or if during the term of the contract, the Department of Taxation and Finance or SUNY discovers that the certification, made under penalty of perjury, is false, then such failure to file or false certification shall be a material breach of this contract and this contract may be terminated, by providing written notification to the Contractor in accordance with the terms of the contract, if SUNY determines that such action is in the best interests of the State.

27. **IRAN DIVESTMENT ACT**. By entering into this contract, Contractor certifies in accordance with State Finance Law §165-a that it is not on the "Entities Determined to be Non-Responsive Bidders/Offerers pursuant to the New York State Iran Divestment Act of 2012" ("Prohibited Entities List") posted at: https://ogs.ny.gov/iran-divestment-act-2012.

Contractor further certifies that it will not utilize on this contract any subcontractor that is identified on the Prohibited Entities List. Contractor agrees that should it seek to renew or extend this contract, it must provide the same certification at the time the contract is renewed or extended. Contractor also agrees that any proposed Assignee of this contract will be required to certify that it is not on the Prohibited Entities List before the contract assignment will be approved by the State.

During the term of the contract, should SUNY receive information that a person (as defined in State Finance Law §165-a) is in violation of the above-referenced certifications, SUNY will review such information and offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment activity which is in violation of the Act within 90 days after the determination of such violation, then SUNY shall take such action as may be appropriate and provided for by law, rule, or contract, including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.

SUNY reserves the right to reject any bid, request for assignment, renewal or extension for an entity that appears on the Prohibited Entities List prior to the award, assignment, renewal or extension of a contract, and to pursue a responsibility review with respect to any entity that is awarded a contract and appears on the Prohibited Entities list after contract award.

28**. ADMISSIBILITY OF REPRODUCTION OF CONTRACT**. Notwithstanding the best evidence rule or any other legal principle or rule of evidence to the contrary, the Contractor acknowledges and agrees that it waives any and all objections to the admissibility into evidence at any court proceeding or to the use at any examination before trial of an electronic reproduction of this contract, in the form approved by the State Comptroller, if such approval was required, regardless of whether the original of said contract is in existence.

THE FOLLOWING PROVISIONS SHALL APPLY ONLY TO THOSE CONTRACTS TO WHICH A HOSPITAL OR OTHER HEALTH SERVICE FACILITY IS A PARTY

29. Notwithstanding any other provision in this contract, the hospital or other health service facility remains responsible for insuring that any service provided pursuant to this contract complies with all pertinent provisions of Federal, state and local statutes, rules and regulations. In the foregoing sentence, the word "service" shall be construed to refer to the health care service rendered by the hospital or other health service facility.

30. (a) In accordance with the 1980 Omnibus Reconciliation Act (Public Law 96-499), Contractor hereby agrees that until the expiration of four years after the furnishing of services under this agreement, Contractor shall make available upon written request to the Secretary of Health and Human Services, or upon request, to the Comptroller General of the United States or any of their duly authorized representatives, copies of this contract, books, documents and records of the Contractor that are necessary to certify the nature and extent of the costs hereunder.

(b) If Contractor carries out any of the duties of the contract hereunder, through a subcontract having a value or cost of $10,000 or more over a twelve-month period, such subcontract shall contain a clause to the effect that, until the expiration of four years after the furnishing of such services pursuant to such subcontract, the subcontractor shall make available upon written request to the Secretary of Health and Human Services or upon request to the Comptroller General of the United States, or any of their duly authorized representatives, copies of the subcontract and books, documents and records of the subcontractor that are necessary to verify the nature and extent of the costs of such subcontract.

(c) The provisions of this section shall apply only to such contracts as are within the definition established by the Health Care Financing Administration, as may be amended or modified from time to time.

31. Hospital Retained Authority: Hospital Retained Authority: The Hospital retains direct, independent authority over the appointment and/or dismissal, in its sole discretion, of the facility's management level employees (including but not limited to, the Facility/Service Administrator/Director, the Medical Director, the Director of Nursing, the Chief Executive Officer, the Chief Financial Officer and the Chief Operating Officer) and all licensed or certified health care staff. The Hospital retains the right to adopt and approve, at its sole discretion, the facility's operating and capital budgets. The Hospital retains independent control over and physical possession of the facility's books and records. The Hospital retains independent control over and physical possession of the facility's operating policies and procedures. The Hospital retains full authority and responsibility for, and control over, the operations and management of the facility. The Hospital retains the right and authority to independently adopt, approve and enforce, in its sole discretion, policies affecting the facility's delivery of health care services. The Hospital retains the right to independently adopt, approve and enforce, at its sole discretion, the disposition of assets and authority to incur debts. The Hospital retains the right to approve, at its sole discretion, contracts for administrative services, management and/or clinical services. The Hospital retains the right to approve, at its sole discretion, any facility debt. The Hospital retains the right to approve, at its sole discretion, settlements of administrative proceeding or litigation to which the facility is a party. No powers specifically reserved to the Hospital may be delegated to, or shared by, the Contractor or any other person. In addition, if there is any disagreement between the parties to this Agreement regarding control between the Hospital and the Contractor, the terms of this Section shall control.

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New York State Vendor Responsibility

Cornell University recommends that vendors file the required Vendor Responsibility Questionnaire online via the New York State VendRep System. To enroll in and use the New York State VendRep System, see the VendRep System Instructions available at

http://www.osc.state.ny.us/vendrep/vendor_index.htm

or go directly to the VendRep System online at https://portal.osc.state.ny.us.

Vendors must provide their New York State Vendor Identification Number when enrolling. To request assignment of a Vendor ID or for VendRep System assistance, contact the Office of the State Comptroller's Help Desk at 866-370-4672 or 518-408-4672 or by email at

ciohelpdesk@osc.state.ny.us.

When enrolled in the VendRep System, your company will be able to:

- Find out if your new contract or change order is being reviewed by OSC and if it has been approved (or non-approved) – you can know the very next business day.
- Complete your CCA-2 online once for multiple State agencies to view. If your company bids on multiple State contracts, or submits bids to multiple State agencies, you won't need to submit multiple questionnaires.
- Revise as needed by updating only relevant responses, easily view the entire questionnaire and re-certify with just a few simple keystrokes.
- Attach documents in response to most questions.

Vendors opting to complete and submit a paper questionnaire can obtain the appropriate questionnaire from the VendRep website

www.osc.state.ny.us/vendrep

or may contact the Facilities Contracts Office (607-255-3982) or the Office of the State Comptroller's Help Desk for a copy of the paper form.

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NEW YORK STATE DEPARTMENT OF LABOR
PREVAILING WAGE RATES

FOR

RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE – PHASE 2

CORNELL UNIVERSITY
ITHACA, NEW YORK

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Cornell University

Breanna Brann, Contracts Specialist
121 Humphreys Service Building
Ithaca NY 14853

Schedule Year	2024 through 2025
Date Requested	05/28/2025
PRC#	2025006392

Location	Livestock Pavilion
Project ID#	eB #12932
Project Type	Renovate Livestock Pavilion for Surge Space Phase 2

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Rate Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2024 through June 2025. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.ny.gov. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____

Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

General Provisions of Laws Covering Workers on Article 8 Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Contractor Registry

Effective December 30, 2024 all contractors and subcontractors submitting bids or performing construction work on public work projects, or private projects covered by Article 8 of the Labor Law, are required to register with the New York State Department of Labor (NYSDOL) under Labor Law Section 220-i. To register, contractors and subcontractors must submit an application through NYSDOL's Contractor Registry portal which is available through the agency's Management System for Protecting Worker Rights (MPWR) https://mpwr-public.labor.ny.gov/en/login.

For additional information, please visit online.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission: a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion online.

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule form the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12226; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.ny.gov.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.ny.gov.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website

www.labor.ny.gov.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemperaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment.Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed $100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds $25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

The "Public Work Project" notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers. compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers. Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12226 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of $50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Cornell University

Breanna Brann, Contracts Specialist
121 Humphreys Service Building
Ithaca NY 14853

Schedule Year 2024 through 2025
Date Requested 05/28/2025
PRC# 2025006392

Location Livestock Pavilion
Project ID# eB #12932
Project Type Renovate Livestock Pavilion for Surge Space Phase 2

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information
All information must be supplied

Federal Employer Identification Number: _____

Name: _____

Address: _____

_____

City: _____ State: _____ Zip: _____

Amount of Contract: $_____

Approximate Starting Date: ____/____/____

Approximate Completion Date: ____/____/____

Contract Type:
[ ] (01) General Construction
[ ] (02) Heating/Ventilation
[ ] (03) Electrical
[ ] (04) Plumbing
[ ] (05) Other : _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12226

Social Security Numbers on Certified Payrolls:

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to $1,500 for a first offense and up to $5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, https://dol.ny.gov/public-work-and-prevailing-wage
If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: dol.misclassified@labor.ny.gov .

Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)

Effective June 23, 2020

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage and supplement rate* for their particular job classification *on each pay stub**. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website *www.labor.ny.gov* or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. *In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

(12.20)

To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

Budget Policy & Reporting Manual

B-610

Public Work Enforcement Fund

effective date December 7, 2005

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1. Purpose and Scope:

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

2. Background and Statutory References:

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

3. Procedures and Agency Responsibilities:

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor
Administrative Finance Bureau-PWEF Unit
Building 12, Room 464
State Office Campus
Albany, NY 12226

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.

NEW YORK STATE OF OPPORTUNITY. Department of Labor

Required Notice under Article 25-B of the Labor Law

Attention All Employees, Contractors and Subcontractors: You are Covered by the Construction Industry Fair Play Act

The law says that you are an employee unless:

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.

Employee Rights: If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

Independent Contractors: If you are an independent contractor**, you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

Penalties for paying workers off the books or improperly treating employees as independent contractors:

• **Civil Penalty**	First offense: Up to $2,500 per employee Subsequent offense(s): Up to $5,000 per employee
• **Criminal Penalty**	First offense: Misdemeanor - up to 30 days in jail, up to a $25,000 fine and debarment from performing public work for up to one year. Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a $50,000 fine and debarment from performing public work for up to 5 years.

If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to dol.misclassified@labor.ny.gov. All complaints of fraud and violations are taken seriously. You can remain anonymous.

Employer Name:

IA 999 (09/16)

WE ARE YOUR DOL

NEW YORK STATE Department of Labor

New York State Department of Labor
Bureau of Public Work

Attention Employees

THIS IS A:

PUBLIC WORK PROJECT

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Your pay stub and wage notice received upon hire must clearly state your wage rate and supplement rate.

Chapter 629 of the Labor Laws of 2007:

These wages are set by law and must be posted at the work site. They can also be found at: https://dol.ny.gov/bureau-public-work

If you feel that you have not received proper wages or benefits, please call our nearest office.*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5287		

* For New York City government agency construction projects, please contact the Office of the NYC Comptroller at (212) 669-4443, or www.comptroller.nyc.gov – click on Bureau of Labor Law.

Contractor Name: _____

Project Location: _____

Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is $250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training “prior to the performing any work on the project.”

The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.)*
- Training roster, attendance record of other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

**A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

WICKS

Public work projects are subject to the Wicks Law requiring separate specifications and bidding for the plumbing, heating and electrical work, when the total project's threshold is $3 million in Bronx, Kings, New York, Queens and, Richmond counties; $1.5 million in Nassau, Suffolk and Westchester counties; and $500,000 in all other counties.

For projects below the monetary threshold, bidders must submit a sealed list naming each subcontractor for the plumbing, HVAC and electrical and the amount to be paid to each. The list may not be changed unless the public owner finds a legitimate construction need, including a change in specifications or costs or the use of a Project Labor Agreement (PLA), and must be open to public inspection.

Allows the state and local agencies and authorities to waive the Wicks Law and use a PLA if it will provide the best work at the lowest possible price. If a PLA is used, all contractors shall participate in apprentice training programs in the trades of work it employs that have been approved by the Department of Labor (DOL) for not less than three years. They shall also have at least one graduate in the last three years and use affirmative efforts to retain minority apprentices. PLA's would be exempt from Wicks, but deemed to be public work subject to prevailing wage enforcement.

The Commissioner of Labor shall have the power to enforce separate specification requirement s on projects, and may issue stop-bid orders against public owners for non-compliance.

Other new monetary thresholds, and similar sealed bidding for non-Wicks projects, would apply to certain public authorities including municipal housing authorities, NYC Construction Fund, Yonkers Educational Construction Fund, NYC Municipal Water Finance Authority, Buffalo Municipal Water Finance Authority, Westchester County Health Care Association, Nassau County Health Care Corp., Clifton-Fine Health Care Corp., Erie County Medical Center Corp., NYC Solid Waste Management Facilities, and the Dormitory Authority.

Contractors must pay subcontractors within a 7 days period.

(07.19)

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less that six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.ny.gov) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12226

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

Tompkins County General Construction

Boilermaker — 05/01/2025

JOB DESCRIPTION Boilermaker **DISTRICT** 7

ENTIRE COUNTIES
Cayuga, Clinton, Cortland, Franklin, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Seneca, St. Lawrence, Tompkins

WAGES

Per hour:	07/01/2024
Boilermaker	$ 37.98

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyworker	$ 26.62* + 1.48

*This portion of the benefits subject to the same premium rate as shown for overtime wages.

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 25) on HOLIDAY PAGE
NOTE: When a holiday falls on Sunday, the day observed by the State or Nation shall be observed. When Christmas Day and New Year's fall on Saturday, Friday will be observed as the holiday.

REGISTERED APPRENTICES
WAGES per hour: Six (6) month terms at the following percentage of Journeyworker's wage.

1st	2nd	3rd	4th	5th	6th	7th	8th
65%	65%	70%	75%	80%	85%	90%	95%

SUPPLEMENTAL BENEFITS per hour:

$ 19.78* + 1.48	$ 19.78* + 1.48	$ 20.76* + 1.48	$ 21.73* + 1.48	$ 22.71* + 1.48	$ 23.69* + 1.48	$24.67* + 1.48	$ 25.64* + 1.48

*This portion of the benefits subject to the same premium rate as shown for overtime wages.

7-175

Carpenter - Building — 05/01/2025

JOB DESCRIPTION Carpenter - Building **DISTRICT** 2

ENTIRE COUNTIES
Chemung, Cortland, Jefferson, Lewis, Oswego, Schuyler, St. Lawrence, Steuben, Tompkins

PARTIAL COUNTIES
Allegany: Only the Township of Alfred.

WAGES

Per hour:	07/01/2024	07/01/2025 Additional
Carpenter	$ 31.10	$ 1.00*
Floor Coverer	31.10	1.00*
Carpet Layer	31.10	1.00*
Dry-Wall	31.10	1.00*
Diver-Wet Day	61.25	0.00
Diver -Dry Day	32.10	1.00*
Diver Tender	32.10	1.00*

*To be allocated at a later date

NOTE ADDITIONAL AMOUNTS PAID FOR THE FOLLOWING WORK LISTED BELOW (per hour worked):
- Pile Drivers/Dock Builders shall receive $0.25 per hour over the journeyworker's rate of pay when performing piledriving/dock building work.
- Certified welders shall receive $1.00 per hour over the journeyworker's rate of pay when the employee is required to be certified and performs DOT or ABS specified welding work

- When an employee performs work within a contaminated area on a State and/or Federally designated hazardous waste site, and where relevant State and/or Federal regulations require employees to be furnished and use or wear required forms of personal protection, then the employee shall receive his regular hourly rate plus $1.50 per hour.
- Depth pay for Divers based upon deepest depth on the day of the dive (per diem payment):
  0' to 80' no additional fee
  81'to 100' additional $.50 per foot
  101'to 150' additional $0.75 per foot
  151'and deeper additional $1.25 per foot
- Penetration pay for Divers based upon deepest penetration on the day of the dive (per diem payment):
  0' to 50' no additional fee
  51' to 100' additional $.75 per foot
  101' and deeper additional $1.00 per foot
- Diver rates applies to all hours worked on dive day.

SHIFT WORK

On Agency/Owner mandated shift work, the following rates will be applicable:
1st Shift - Regular Rate
2nd Shift - Premium of 7% of base wage per hour
3rd Shift - Premium of 14% of base wage per hour

Shift work shall be defined as implementing at least two (2) shifts in a twenty-four (24) consecutive hour period. Shift work must be for a minimum of three (3) consecutive days.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker	$ 22.88*

*NOTE: For work performed inside the secure area of Nuclear Power Plants - benefits calculated at same premium as shown for overtime(per hour paid).

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

Note: Any holiday which occurs on Sunday shall be observed the following Monday. If Christmas falls on a Saturday, it shall be observed on the prior Friday.

REGISTERED APPRENTICES

Wages per hour (1300 hour terms at the following percentage of Journeyworker's base wage):

1st	2nd	3rd	4th
65%	70%	75%	80%

Supplemental Benefits per hour:

$ 12.55	$ 12.55	$ 15.15	$ 15.15

NOTE ADDITIONAL AMOUNTS PAID TO APPRENTICES FOR THE FOLLOWING WORK LISTED BELOW (per hour worked):
- Pile Driving/Dock Builder apprentices shall receive an additional $0.25 per hour worked when performing piledriving/dock building work.
- Certified Welders shall receive $1.00 per hour over the apprentices rate of pay when the apprentice is required to be certified and performs DOT or ABS specified welding work.
- When an apprentice performs work within a contaminated area on a State and/or Federally designated hazardous waste site, and where relevant State and/or Federal regulations require the apprentice to be furnished and use or wear required forms of personal protection, then the apprentice shall receive his regular hourly rate plus $1.50 per hour.

2-277B-CS

Carpenter - Building / Heavy&Highway 05/01/2025

JOB DESCRIPTION Carpenter - Building / Heavy&Highway **DISTRICT** 2

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES

Orange: The area lying on Northern side of Orange County demarcated by a line drawn from the Bear Mountain Bridge continuing west to the Bear Mountain Circle, continue North on 9W to the town of Cornwall where County Road 107 (also known as Quaker Rd) crosses under 9W, then east on County Road 107 to Route 32, then north on Route 32 to Orrs Mills Rd, then west on Orrs Mills Rd to Route 94, continue west and south on Route 94 to the Town of Chester, to the intersection of Kings Highway, continue south on Kings Highway to Bellvale Rd, west on Bellvale Rd to Bellvale Lakes Rd, then south on Bellvale Lakes Rd to Kain Rd, southeast on Kain Rd to Route 17A, then north and southeast along Route 17A to Route 210, then follow Route 210 to NJ Border.

WAGES

Wages per hour:	07/01/2024
Carpenter - ONLY for Artificial Turf/Synthetic Sport Surface	$ 36.48

Note - Does not include the operation of equipment. Please see Operating Engineers rates.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 26.55

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE

HOLIDAY
Paid: See (5) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE
Notes:
When a holiday falls upon a Saturday, it shall be observed on the preceding Friday. Whan a holiday falls upon a Sunday, it shall be observed on the following Monday.
An employee taking an unexcused day off the regularly scheduled day before or after a paid Holiday shall not receive Holiday pay.

REGISTERED APPRENTICES
Wages per hour (1300 hour terms at the following percentage of Journeyworker's wage):

1st	2nd	3rd	4th
65%	70%	75%	80%

Supplemental Benefits per hour:

$18.58	$19.14	$21.24	$21.79

2-42AtSS

Carpenter - Heavy&Highway — 05/01/2025

JOB DESCRIPTION Carpenter - Heavy&Highway **DISTRICT** 2

ENTIRE COUNTIES
Broome, Cayuga, Chemung, Cortland, Delaware, Jefferson, Lewis, Onondaga, Oswego, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Yates

WAGES

Per hour	07/01/2024
Carpenter	$ 38.28
Piledriver	38.28
Diver-Wet Day	63.28
Diver-Dry Day	39.28
Diver-Tender	39.28

NOTE ADDITIONAL AMOUNTS PAID FOR THE FOLLOWING WORK LISTED BELOW (per hour worked):
- State or Federal designated hazardous site, requiring protective gear shall be an additional $2.50 per hour.
- Certified welders when required to perform welding work will receive an additional $2.50 per hour.

ADDITIONAL NOTES PERTAINING TO DIVERS/TENDERS:
- Divers and Tenders shall receive one and one half (1 1/2) times their regular diver and tender rate of pay for Effluent and Slurry diving.
- Divers and tenders being paid at the specified rate for Effluent and Slurry diving shall have all overtime rates based on the specified rate plus the appropriate overtime rates (one and one half or two times the specified rate for Slurry and Effluent divers and tenders).
- The pilot of an ADS or submersible will receive one and one-half (1 1/2) times the Diver-Wet Day Rate for time submerged.
- All crew members aboard a submersible shall receive the Diver-Wet Day rate.
- Depth pay for Divers based upon deepest depth on the day of the dive (per diem payment):
  0' to 50' no additional fee
  51'to 100' additional $.50 per foot
  101'to 150' additional $0.75 per foot
  151'and deeper additional $1.25 per foot
- Penetration pay for Divers based upon deepest penetration on the day of the dive (per diem payment):
  0' to 50' no additional fee
  51' to 100' additional $.75 per foot
  101' and deeper additional $1.00 per foot
- Diver rates applies to all hours worked on dive day.

SHIFT WORK

When project owner mandates a single irregular work shift, the Journeyworkers and Apprentices will receive an additional $3.00 per hour. A single irregular work shift can start any time from 5:00 p.m. to 1:00 a.m.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 26.55

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
- In the event a Holiday falls on a Saturday, the Friday before will be observed as a Holiday. If a Holiday falls on a Sunday, then Monday will be observed as a Holiday.
- The employee must work their scheduled workday before and their scheduled workday after the holiday to receive holiday pay.

REGISTERED APPRENTICES
CAPRENTER APPRENTICES
Wages per hour (1040 hour terms at the following percentage of journeyworker's base wage):

1st	2nd	3rd	4th	5th
65%	70%	75%	80%	85%

Supplemental Benefits per hour:

$ 18.58	$ 19.14	$ 21.19	$ 21.74	$ 22.29

PILEDRIVER/DOCKBUILDER APPRENTICES
Wages per hour (1300 hour terms at the following percentage of journeyworker's base wage):

1st	2nd	3rd	4th
65%	70%	75%	80%

Supplemental Benefits per hour:

$ 18.58	$ 19.14	$ 21.19	$ 21.74

NOTE ADDITIONAL AMOUNTS PAID PER HOUR WORKED TO APPRENTICES FOR SPECIFIC TYPES OF WORK PERFORMED:
- State or Federal designated hazardous site, requiring protective gear shall be an additional $2.50 per hour.
- Certified welders when required to perform welding work will receive an additional $2.50 per hour.

2-277HH-Bro

Electrician 05/01/2025

JOB DESCRIPTION Electrician **DISTRICT** 6

ENTIRE COUNTIES
Cortland, Herkimer, Madison, Oneida, Oswego

PARTIAL COUNTIES
Cayuga: Townships of Ira, Locke, Sempronius, Sterling, Summerhill and Victory.
Chenango: Only the Townships of Columbus, New Berlin and Sherburne.
Onondaga: Entire County except Townships of Elbridge and Skaneateles.
Otsego: Only the Townships of Plainfield, Richfield, Springfield, Cherry Valley, Roseboom, Middlefield, Otsego, Exeter, Edmeston, Burlington, Pittsfield and New Lisbon.
Tompkins: Only the Township of Groton.
Wayne: Only the Townships of Huron, Wolcott, Rose and Butler.

WAGES

Per hour:	07/01/2024	06/01/2025 Additional	06/01/2026 Additional
Electrician	$ 47.00	$ 5.00*	$ 5.25*
Teledata	47.00		
Cable Splicer	51.70		

* To be allocated at a later date.

NOTE: Additional premiums for the following work listed (Amounts subject to premiums):
- Additional $2.50 per hour for work performed over 35 feet above the ground, floor, or roof levels or where work is required in tunnels, shafts, or under compressed air 35 feet below the ground level.
- Additional $3.00 per hour for working over 50 feet above or below ground, floor, or roof level. This includes work on ladders, "toothpicks", scaffolds, boatswain chairs, towers, smokestacks or other open structures, or mechanical lifts used over 60 feet.

Occupied Conditions: When necessary to perform alteration and/or renovation work and owner mandates (due to occupied conditions) prevent the work from being performed during "normal" working hours (defined as between 6:00 a.m. and 4:30 p.m. Monday through Friday), alternate hours may be worked, provided: 1) The hours are established for a minimum of five (5) days duration or the length of the job, whichever is shorter; and 2) An entire work scope within a job-site area is performed utilizing the varied hours. If these conditions are satisfied, all hours worked Monday through Friday of a shift that starts before or ends after the "normal" hours, shall be paid at the appropriate rate plus fifteen percent (15%). However, the following restrictions shall apply:

1) "Alternate" hours shall consist of a minimum of eight (8) consecutive hours per day.
2) Hours worked in excess of eight (8) hours per day, Monday through Friday, shall be paid at a rate of one and one-half times the applicable rate (day-shift + 15%).
3) Hours worked on Saturday shall be paid at time and one-half the applicable rate.
4) Hours worked on Sundays and Holidays shall be paid at double the straight time rate.
5) Work of a new construction nature may not be worked under these conditions.

SHIFT WORK
THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF EIGHT (8) HOURS FOR AT LEAST FIVE (5) DAYS DURATION WHICH MAY HAVE BEEN WORKED. WHEN TWO (2) SHIFTS OR THREE (3) SHIFTS ARE WORKED:

1ST SHIFT	8:00AM - 4:30PM:	Regular wage rate
2ND SHIFT	4:30 PM - 1:00 AM:	Regular wage rate plus 15%
3RD SHIFT	12:30 AM - 9:00 AM:	Regular wage rate plus 25%

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 31.92 plus 3% of hourly wage paid*

*NOTE: The 3% is based on the hourly wage paid, straight time or premium rate.

OVERTIME PAY
See (B, *E, Q) on OVERTIME PAGE
* NOTE: On Saturday the first 8 hours worked shall be paid at a rate of one and one-half times the applicable rate. All additional hours are payable at double the straight time rate.
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 26) on HOLIDAY PAGE
NOTE: If any of the above holidays fall on Saturday, Friday shall be observed as the holiday. If any of the above holidays fall on Sunday, Monday shall be observed as the holiday.

REGISTERED APPRENTICES
WAGES per hour: Hourly terms at the following percentage of Journeyworker's wage.

1st period 40% (0-1000 hrs.)	$ 18.80
2nd period 45% (1001-2000)	21.15
3rd period 50% (2001-3500)	23.50
4th period 60% (3501-5000)	28.20
5th period 70% (5001-6500)	32.90
6th Period 80% (6501-8000)	37.60

SUPPLEMENTAL BENEFITS per hour:

1st period	$ 14.34*
2nd period	14.34*
3rd period	28.92*
4th period	29.52*
5th period	30.12*
6th period	30.72*

* PLUS 3% OF HOURLY WAGE PAID, STRAIGHT TIME RATE OR PREMIUM RATE.

6-43

Electrician — 05/01/2025

JOB DESCRIPTION Electrician **DISTRICT** 6

ENTIRE COUNTIES

PARTIAL COUNTIES
Cayuga: Only the Township of Genoa.
Schuyler: Only the Townships of Cayuta, Catharine, and Hector.
Seneca: Only the Townships of Lodi and Covert.
Tioga: Only the Townships of Spencer and Candor.
Tompkins: Entire county except the Township of Groton.

WAGES

Per hour:	07/01/2024
Electrician	$ 42.00

Additional $1.00 per hour for work from trusses, scaffolds, frames, spider baskets, ladders, etc. 40 feet or more from ground floor or in underground mines or tunnels. Work done from personal lift equipment that complies with OSHA requirements are excluded.

Additional $2.00 per hour when required to work under compressed air, on radio towers, on asbestos abatement projects which require the use of a respirator, work of a hazardous nature, work where gas masks are required or work requiring use of protective arc flash suits.

NOTE: Additional amounts subject to premiums.

SHIFT WORK

THE FOLLOWING RATES WILL APPLY WHEN SHIFT WORK IS MANDATED EITHER IN THE JOB SPECIFICATION OR BY THE CONTRACTING AGENCY:

1ST SHIFT	8:00 AM to 4:30 PM	Regular wage rate
2ND SHIFT	4:30 PM to 1:00 AM	Regular wage rate plus 17.3%
3RD SHIFT	12:30 AM to 9:00 AM	Regular wage rate plus 31.4%

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyworker	$ 29.55 plus 3% of hourly wage paid*

* NOTE: The 3% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY

See (B, *E, Q) on OVERTIME PAGE

* NOTE: On Saturday the first 8 hours worked shall be paid at a rate of one and one-half times the applicable rate. All additional hours are payable at double the straight time rate.

WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6) on HOLIDAY PAGE

NOTE: When a holiday falls on a Saturday, the day preceding shall be celebrated as such, and when falling on a Sunday, Monday will be celebrated as the holiday.

REGISTERED APPRENTICES

WAGES per hour: One year terms at the following percentage of Journeyworker's wage.

1st year (47.5%)	$ 19.95
2nd year (52.5%)	22.05
3rd year (65%)	27.30
4th year (75%)	31.50
5th year (85%)	35.70

SUPPLEMENTAL BENEFITS per hour:

1st year	$ 13.75*
2nd year	13.75*
3rd year	22.47*
4th year	23.97*
5th year	25.46*

* PLUS 3% OF HOURLY WAGE PAID, STRAIGHT TIME RATE OR PREMIUM RATE.

6-241

Elevator Constructor — 05/01/2025

JOB DESCRIPTION Elevator Constructor **DISTRICT** 6

ENTIRE COUNTIES

Broome, Cayuga, Chenango, Cortland, Franklin, Jefferson, Lewis, Onondaga, Oswego, St. Lawrence, Tioga, Tompkins

PARTIAL COUNTIES

Delaware: Only the towns of: Tompkins, Walton, Masonville, Sidney, Franklin and Deposit.
Madison: Only the towns of: Cazenovia, DeRuyter, Eaton, Fenner, Georgetown, Lebanon, Lenox, Nelson and Sullivan.
Oneida: Only the towns of: Camden, Florence and Vienna.

WAGES

Per hour:	07/01/2024	01/01/2025	01/01/2026
Elevator Constructor	$ 56.01	$ 58.455	$ 61.003
Helper	39.21	40.92	42.70

SUPPLEMENTAL BENEFITS

Per hour:			
Journeyworker	$ 37.885*	$ 38.435*	$ 38.985*

*NOTE - add 6% of regular hourly rate for all hours worked. Add 8% of regular hourly rate if more than 5 years of service.

OVERTIME PAY
See (D, O) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 15, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE
NOTE: When a holiday falls on a Saturday, it shall be observed on Friday. When a holiday falls on Sunday, it shall be observed on Monday.

REGISTERED APPRENTICES
WAGES per hour: 1 year terms at the following percentage of the Elevator Constructor wage.

0-6 months	6-12 months	2nd year	3rd year	4th year
50%	55%	65%	70%	80%

SUPPLEMENTAL BENEFITS per hour:

0-6 months: 6% of the hourly apprentice rate paid, no additional supplemental benefits.

All other terms: Same as Journeyworker

6-62.1

Glazier — 05/01/2025

JOB DESCRIPTION Glazier **DISTRICT** 5

ENTIRE COUNTIES
Broome, Chemung, Chenango, Delaware, Otsego, Schuyler, Steuben, Tioga, Tompkins

WAGES

Per hour:	07/01/2024
Glazier	$ 28.90

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyman	$ 30.20

OVERTIME PAY
See (B, E*, E2, Q**) on OVERTIME PAGE.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
1000 hour terms

Appr. 1st term	$18.00
Appr. 2nd term	19.00
Appr. 3rd term	20.00
Appr. 4th term	21.00
Appr. 5th term	22.00
Appr. 6th term	23.00
Appr. 7th term	24.00
Appr. 8th term	25.00

Supplemental Benefits per hour:

Appr. 1st term	$ 13.22
Appr. 2nd term	13.22
Appr. 3rd term	19.22
Appr. 4th term	19.22
Appr. 5th term	20.22
Appr. 6th term	20.22
Appr. 7th term	21.22
Appr. 8th term	21.22

5-677z3

Insulator - Heat & Frost — 05/01/2025

JOB DESCRIPTION Insulator - Heat & Frost **DISTRICT** 7

ENTIRE COUNTIES
Broome, Cayuga, Chemung, Chenango, Cortland, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Otsego, Schuyler, Seneca, St. Lawrence, Tioga, Tompkins

WAGES
Per hour: 07/01/2024

Asbestos Installer	$ 41.50
Insulation Installer	41.50
(On mechanical systems only)	

SHIFT WORK
The following rates will apply on all contracting agency-mandated shifts worked:

1st Shift	$ 41.50
2nd Shift	47.72
3rd Shift	49.80

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 25.09

OVERTIME PAY
See (*B1, **K, P) on OVERTIME PAGE
*NOTE: First 10 hours on Saturday.
**NOTE: Holidays that fall on Sunday are subject to double time.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (2*,4,6,28) on HOLIDAY PAGE
*Triple time for Labor Day if worked.

REGISTERED APPRENTICES
WAGES per hour: One (1) year terms at the following percentage of Journeyworker's wage.

1st	2nd	3rd	4th
60%	70%	80%	90%
$ 24.90	$ 29.05	$ 33.20	$ 37.35

SUPPLEMENTAL BENEFITS per hour:

$ 22.59	$ 22.59	$ 25.09	$ 25.09

7-30-Syracuse

Ironworker — 05/01/2025

JOB DESCRIPTION Ironworker **DISTRICT** 6

ENTIRE COUNTIES
Broome, Cayuga, Cortland, Onondaga, Oswego, Seneca, Tioga, Tompkins

PARTIAL COUNTIES
Chenango: Only the townships of Afton, Bainbridge, Coventry, German, Greene, Guilford, Lincklaen, McDonough, Norwich, Otselic, Oxford, Pharsalia, Pitcher, Preston and Smithville.
Jefferson: Only the townships of Adams, Alexandria, Brownville, Cape Vincent, Clayton, Ellisburg, Henderson, Hounsfield, LeRay, Lorraine, Lyme, Orleans, Pamelia, Rodman, Rutland, Theresa, Watertown and Worth.
Madison: Only the townships of Cazenovia, DeRuyter, Fenner, Georgetown, Lenox, Lincoln, Nelson, Smithfield and Sullivan.
Schuyler: Only the townships of Cayuta, Catharine, Hector and Montour.
Wayne: Only the townships of Butler, Galen, Huron, Rose, Savannah and Wolcott.

WAGES

Structural, Reinforcing, Re-bar, Machinery Mover & Rigger, Ornamental & Curtain Wall, Window Wall, Pre-Glazed Metal Framed Windows Attached to Steel or Masonry Including Caulking, Fence Erector (Chain Link/Security), Sheeter/Bridge Rail, Pre-Cast Erector, Stone Derrickman, Pre-Engineered Building Erector, Welder

Per hour:	07/01/2024	07/01/2025 Additional	07/01/2026 Additional
Ironworker	$ 34.65	$ 2.66*	$ 2.76*

*To be allocated at a later date.

SHIFT WORK
Multiple shifts mandated by the project owner. All shifts will be eight (8) hours.

1st Shift	$ 34.65	
2nd Shift	38.12	Starting times between 2PM and 7PM
3rd Shift	39.85	Starting times between 7PM and 12AM

WHEN A SINGLE IRREGULAR SHIFT IS WORKED, WITH START TIMES BASED ON SECOND AND THIRD SHIFTS, ADD 10% TO THE 1ST SHIFT WAGE RATE POSTED ABOVE.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 31.73

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: Any holiday which occurs on Saturday shall be observed on the preceding Friday. Any holiday which occurs on Sunday shall be observed the following Monday.

REGISTERED APPRENTICES
WAGES per hour: One year terms at the following rates.

1st	2nd	3rd	4th
$ 21.50	$ 23.50	$ 25.50	$ 27.50

SUPPLEMENTAL BENEFITS per hour:

1st year	$ 12.53
2nd year	20.86
3rd year	22.05
4th year	23.24

Laborer - Building — 05/01/2025

JOB DESCRIPTION Laborer - Building **DISTRICT** 2

ENTIRE COUNTIES
Cortland, Tompkins

PARTIAL COUNTIES
Schuyler: Only the Township of Catherine including the Village of Odessa.
Tioga: Townships of Candor & Spencer

WAGES
Per hour:

GROUP #1: Basic Laborer - excavation, concrete vibrator, power-driven buggie, demolition (including acetylene torch work) that is customarily done by a laborer

GROUP #2: Air Tool Operators, Mason Tenders

GROUP #3: Blaster, Rock Drill (compressor driven)

GROUP #4: Asbestos, Hazardous, Toxic Waste, Lead and Mold Remediation

	07/01/2024	07/01/2025 Additional	07/01/2026 Additional
GROUP #1	$ 26.50	$ 1.00*	$ 1.25*

GROUP #2	27.50	1.00*	1.25*
GROUP #3	28.50	1.00*	1.25*
GROUP #4	28.50	1.00*	1.25*

*To be allocated at a later date.

IMPORTANT NOTES:
- Laborer tasks on Renewable Energy and Green Energy construction work shall be paid at the appropriate Heavy & Highway rates.
- Wage and supplement rates for the operation of forklift and skid steer may be found under the classification "Operating Engineer".

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 22.70

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
When a holiday falls on Sunday, it shall be observed on the following Monday.

REGISTERED APPRENTICES
WAGES: 1000 hour terms at the following percentage of Journeyworker's wage.

1st	2nd	3rd	4th
70%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

1st term	$ 15.35
2nd term	16.60
3rd term	17.48
4th term	18.35

2-785b

Laborer - Heavy&Highway **05/01/2025**

JOB DESCRIPTION Laborer - Heavy&Highway **DISTRICT** 2

ENTIRE COUNTIES
Broome, Chemung, Cortland, Schuyler, Steuben, Tioga, Tompkins

PARTIAL COUNTIES
Chenango: Entire County except the Townships of Sherburne, Columbus, and New Berlin.
Delaware: Only the Townships of Sidney, Masonville, Walton, Tompkins, Deposit, Hancock and Colchester.

WAGES
Per hour:

GROUP A: Drill Helper, Flagman, Outboard and Hand Boats.

GROUP B: Basic Rate, Bull Float (where used for strike off only), Chain Saw, Concrete Aggregate Bin, Concrete Bootmen, Gin Buggy, Hand or Machine Vibrator, Jack Hammer, Mason Tender, Mortar Mixer, Pavement Breaker, Handlers of Steel Mesh, Small Generators for Laborers Tools, Installation of Bridge Drainage Pipe, Pipe Layers, Vibrator Type Rollers, Tamper, Drill Doctor, Water Pump Operators (1-1/2" & Single Diaphragm), Nozzle (Asphalt, Gunite, Seeding, and Sand Blasting), Laborers on Chain Link Fence Erection, Rock Splitter and Power Unit, Pusher Type Concrete Saw and all other Gas, Electric, and Air Tool Operators, Wrecking Laborer.

GROUP C: Drilling equipment - only where a separate air compressor unit supplies power, Acetylene Torch Operators, Asphalt Raker, Powder Man, Tail or Screw Operator on Asphalt Paver.

GROUP D: Blasters, Form Setters (slab steel forms on highways, roads, streets & airport runways), Stone or Granite Curb Setters.

GROUP E: Hazardous Waste defined as when an employee performs hazardous waste removal, lead abatement and removal, asbestos abatement and removal work on State and/or Federally designated waste site and were relevant State and/or Federal regulations require employees to use or wear required forms of personal protection.

	07/01/2024
GROUP A	$ 35.56

GROUP B	35.76
GROUP C	35.96
GROUP D	36.16
GROUP E	38.76

IMPORTANT NOTES:
- Laborer tasks on Renewable Energy and Green Energy construction work shall be paid at the appropriate Heavy & Highway rates.
- Wage and supplement rates for the operation of forklift and skid steer may be found under the classification "Operating Engineer".
- When an employee is required by the employer and/or by the material data safety sheets of a product, during its application, to wear a half or full-face replaceable cartridge respirator for more than (2) hours, then in such case said employee(s) will be paid the Group E rate for the shift.

SHIFT WORK
A single irregular work shift starting any time between 5:00 PM and 1:00 AM on governmental mandated night work shall be paid an additional $3.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 25.85

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
- If Holiday falls on Sunday, it will be celebrated on Monday. If the Holiday falls on Saturday, it will be celebrated on Saturday.
- An Employee must work the scheduled working day before and the scheduled working day after a holiday to receive holiday pay.

REGISTERED APPRENTICES
WAGES: 1000 hour terms at the following percentage of Journeyworker's GROUP B wage:

1st	2nd	3rd	4th
70%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

1st term	$ 23.60
2nd term	24.35
3rd term	24.73
4th term	25.10

2-785h

Laborer - Tunnel — 05/01/2025

JOB DESCRIPTION Laborer - Tunnel **DISTRICT** 2

ENTIRE COUNTIES
Broome, Chemung, Cortland, Schuyler, Steuben, Tioga, Tompkins

PARTIAL COUNTIES
Chenango: Entire County except the Townships of Sherburne, Columbus, and New Berlin.
Delaware: Only the Townships of Sidney, Masonville, Walton, Tompkins, Deposit, Hancock and Colchester.

WAGES
Per hour:

GROUP A: Change House Man

GROUP B: Miners and all Machine Men, Safety Miner, All Shaft work, Caisson work, Drilling, Blow Pipe, all Air Tools, Tugger, Scaling, Nipper, Guniting pot to nozzle, Bit Grinder, Signal Man (top and bottom), Concrete Man, Shield Driven Tunnels, mixed face and soft ground, liner plate tunnels in free air.

GROUP C: Blaster

GROUP D: Hazardous waste removal work on a State and/or Federally designated waste site where relevant State and/or Federal regulations require employees to use or wear required forms of personal protection.

	07/01/2024
Group A	$ 38.74
Group B	38.94

Group C	41.74
Group D	41.94

IMPORTANT NOTES:
- When an employee is required by the employer and/or by the material data safety sheets of a product, during its application, to wear a half or full face replaceable cartridge respirator for more then (2) hours, then in such case said employee(s) will be paid the Group D rate for the shift.

SHIFT WORK
A single irregular work shift starting any time between 5:00 PM and 1:00 AM on governmental mandated night work shall be paid an additional $3.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 25.85

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE
- If Holiday falls on Sunday, it will be celebrated on Monday. If the Holiday falls on Saturday, it will be celebrated on Friday.

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
If the holiday falls on Saturday, it will be celebrated on Friday. If the holiday falls on Sunday, it will be celebrated on Monday

REGISTERED APPRENTICES
WAGES: 1000 hour terms at the following percentage of Group B wage

1st	2nd	3rd	4th
70%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

1st Term	$ 10.25
2nd Term	10.25
3rd Term	18.25
4th Term	25.85

2-785T

Lineman Electrician — 05/01/2025

JOB DESCRIPTION Lineman Electrician **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

WAGES
A Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors, assembly of all electrical materials, conduit, pipe, or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

Crane Operators: Operation of any type of crane on line projects.
Crawler Backhoe: Operation of tracked excavator/crawler backhoe with 1/2 yard bucket or larger on line projects.
Digging Machine Operator: All other digging equipment and augering on line projects.

A Groundman/Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator/equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

NOTE: Includes Teledata Work within ten (10) feet of High Voltage Transmission Lines. Also includes digging of holes for poles, anchors, footer, and foundations for electrical equipment.

Below rates applicable on all overhead and underground distribution and maintenance work, and all overhead and underground transmission line work and the installation of fiber optic cable where no other construction trades are or have been involved. Includes access matting for line work.

Per hour:	07/01/2024
Group A:	
Lineman, Technician	$ 58.90
Crane, Crawler Backhoe	58.90
Welder, Cable Splicer	58.90
Group B:	
Digging Mach. Operator	53.01
Tractor Trailer Driver	50.07
Groundman, Truck Driver	47.12
Equipment Mechanic	47.12
Flagman	35.34

Additional $1.00 per hour for entire crew when a helicopter is used.

Below rates applicable on all electrical sub-stations, switching structures, fiber optic cable and all other work not defined as "Utility outside electrical work." Includes access matting for line work.

Group A:	
Lineman, Technician	$ 58.90
Crane, Crawler Backhoe	58.90
Cable Splicer	64.79
Certified Welder, Pipe Type Cable	61.85
Group B:	
Digging Mach. Operator	53.01
Tractor Trailer Driver	50.07
Groundman, Truck Driver	47.12
Equipment Mechanic	47.12
Flagman	35.34

Additional $1.00 per hour for entire crew when a helicopter is used.

Below rates applicable on all switching structures, maintenance projects, railroad catenary install/maintenance third rail installation, bonding of rails and pipe type cable and installation of fiber optic cable. Includes access matting for line work.

Group A:	
Lineman, Tech, Welder	$ 60.22
Crane, Crawler Backhoe	60.22
Cable Splicer	66.24
Certified Welder, Pipe Type Cable	63.23
Group B:	
Digging Mach. Operator	54.20
Tractor Trailer Driver	51.19
Groundman, Truck Driver	48.18
Equipment Mechanic	48.18
Flagman	36.13

Additional $1.00 per hour for entire crew when a helicopter is used.

Below rates applicable on all overhead and underground transmission line work & fiber optic cable where other construction trades are or have been involved. This applies to transmission line work only, not other construction. Includes access matting for line work.

Group A:	
Lineman, Tech, Welder	$ 61.41
Crane, Crawler Backhoe	61.41
Group B:	
Digging Mach. Operator	55.27
Tractor Trailer Driver	52.20
Groundman, Truck Driver	49.13
Equipment Mechanic	49.13

Flagman	36.85

Additional $1.00 per hour for entire crew when a helicopter is used.

SHIFT WORK

THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM to 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM to 1:00 AM REGULAR RATE PLUS 17.3 %
3RD SHIFT	12:30 AM to 9:00 AM REGULAR RATE PLUS 31.4 %

SUPPLEMENTAL BENEFITS

Per hour:

	07/01/2024
Group A	$ 30.90 *plus 7% of the hourly wage paid
Group B	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE. NOTE: Double time for all emergency work designated by the Dept. of Jurisdiction.
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.
Overtime	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES

WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyworker's Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

07/01/2024
$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249a

Lineman Electrician - Teledata — 05/01/2025

JOB DESCRIPTION Lineman Electrician - Teledata **DISTRICT** 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour:

For outside work, stopping at first point of attachment (demarcation).

07/01/2024	01/01/2025

Cable Splicer	$ 39.24	$ 40.81
Installer, Repairman	$ 37.24	$ 38.73
Teledata Lineman	$ 37.24	$ 38.73
Tech., Equip. Operator	$ 37.24	$ 38.73
Groundman	$ 19.74	$ 20.53

NOTE: EXCLUDES Teledata work within ten (10) feet of High Voltage (600 volts and over) transmission lines. For this work please see LINEMAN.

SHIFT WORK

THE FOLLOWING RATES APPLY WHEN THE CONTRACTING AGENCY MANDATES MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION ARE WORKED. WHEN TWO (2) OR THREE (3) SHIFTS ARE WORKED THE FOLLOWING RATES APPLY:

1ST SHIFT	REGULAR RATE
2ND SHIFT	REGULAR RATE PLUS 10%
3RD SHIFT	REGULAR RATE PLUS 15%

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2024	01/01/2025
Journeyworker	$ 5.70 *plus 3% of the hour wage paid	$ 5.70 *plus 3% of the hour wage paid

*The 3% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE

6-1249LT - Teledata

Lineman Electrician - Traffic Signal, Lighting — 05/01/2025

JOB DESCRIPTION Lineman Electrician - Traffic Signal, Lighting **DISTRICT** 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

WAGES

Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors which includes, but is not limited to road loop wires; conduit and plastic or other type pipes that carry conductors, flex cables and connectors, and to oversee the encasement or burial of such conduits or pipes.

Crane Operators: Operation of any type of crane on Traffic Signal/Lighting projects.
Crawler Backhoe: Operation of tracked excavator/crawler backhoe with 1/2 yard bucket or larger on Traffic Signal/Lighting projects.
Digging Machine Operator: All other digging equipment and augering on Traffic Signal/Lighting projects.

A Groundman/Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator/equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

A flagger's duties shall consist of traffic control only.

Per hour:	07/01/2024
Group A:	
Lineman, Technician	$ 50.54
Crane, Crawler Backhoe	50.54

Certified Welder	53.07
Group B:	
Digging Machine	45.49
Tractor Trailer Driver	42.96
Groundman, Truck Driver	40.43
Equipment Mechanic	40.43
Flagman	30.32

Above rates are applicable for installation, testing, operation, maintenance and repair on all Traffic Control (Signal) and Illumination (Lighting) projects, Traffic Monitoring Systems, and Road Weather Information Systems. Includes digging of holes for poles, anchors, footer foundations for electrical equipment; assembly of all electrical materials or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

SHIFT WORK

THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM	REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM	REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM	REGULAR RATE PLUS 31.4%

SUPPLEMENTAL BENEFITS

Per hour worked:

	07/01/2024
Group A	$ 30.90 *plus 7% of the hourly wage paid
Group B	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE. NOTE: Double time for all emergency work designated by the Dept. of Jurisdiction.
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid: See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.
Overtime: See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES

WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyworker's Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

07/01/2024
$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249a-LT

Lineman Electrician - Tree Trimmer **05/01/2025**

JOB DESCRIPTION Lineman Electrician - Tree Trimmer **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

WAGES
Applies to line clearance, tree work and right-of-way preparation on all new or existing energized overhead or underground electrical, telephone and CATV lines. This also includes stump removal near underground energized electrical lines including telephone and CATV lines.

Per hour:	07/01/2024
Tree Trimmer	$ 31.44
Equipment Operator	27.80
Equipment Mechanic	27.80
Truck Driver	23.15
Groundman	19.07
Flag person	15.00*

*NOTE-Rate effective on 01/01/2025 - $15.50 due to minimum wage increase.

SUPPLEMENTAL BENEFITS
Per hour:

	07/01/2024
Journeyworker	$ 10.48 *plus 4.5% of the hourly wage paid

* The 4.5% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE
WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (5, 6, 8, 15) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 16, 25) on HOLIDAY PAGE
NOTE: All paid holidays falling on a Saturday shall be observed on the preceding Friday. All paid holidays falling on a Sunday shall be observed on the following Monday.

6-1249TT

Mason - Building — 05/01/2025

JOB DESCRIPTION Mason - Building **DISTRICT** 5

ENTIRE COUNTIES
Cortland, Tompkins

WAGES

Per hour:	07/01/2024
Building:	
Brick/Block layer, Cement Mason Plasterer/EFIS, Stone Mason, Tuck Pointer	$ 33.68

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 28.69

OVERTIME PAY
See (B,E,E2*,Q) on OVERTIME PAGE
*Note - Or other conditions beyond the employer's control such as fire or natural disaster.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:

One year terms at the following wage:

1st	2nd	3rd	4th
$ 21.52	$ 26.58	$ 27.69	$ 30.31

Supplemental Benefits per hour:

1st	2nd	3rd	4th
$ 23.74	$ 24.38	$ 27.07	$ 28.26

5-3B Ith - Z2

Mason - Heavy&Highway 05/01/2025

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 5

ENTIRE COUNTIES
Allegany, Broome, Chautauqua, Chemung, Chenango, Cortland, Delaware, Genesee, Livingston, Monroe, Ontario, Orleans, Otsego, Schuyler, Seneca, Steuben, Tioga, Tompkins, Wayne, Wyoming, Yates

PARTIAL COUNTIES
Cattaraugus: Enitre county except in the Township of Perrysburg and the Village of Gowanda only the Bricklayer classification applies.
Erie: Only the Bricklayer classification applies.
Niagara: Only the Bricklayer classification applies.

WAGES

Per hour:	07/01/2024
Heavy & Highway:	
Cement Mason	$ 37.88
Bricklayer	37.88

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 24.53

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:

1500 hour terms at the following percentage of Journeyman's wage:

1st	2nd	3rd	4th
50%	60%	70%	80%

Supplemental benefits per hour:

1st term	$ 14.53
2nd term	$ 23.57
3rd term	$ 23.81
4th term	$ 24.05

5-3h

Mason - Tile Finisher 05/01/2025

JOB DESCRIPTION Mason - Tile Finisher **DISTRICT** 5

ENTIRE COUNTIES
Broome, Chenango, Cortland, Delaware, Otsego, Tioga, Tompkins

WAGES

Wages	
Per hour:	07/01/2024
Building:	
Marble, Slate, Terrazzo and Tile Finisher	$ 32.00

SUPPLEMENTAL BENEFITS

Per hour:

Journeyman $ 21.47

OVERTIME PAY
See (B,E,E2*,Q) on OVERTIME PAGE
*Note - Or other conditions beyond the employer's control such as fire or natural disaster.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:

One year terms at the following wage:

1st	2nd	3rd
$ 19.20	$ 22.40	$ 25.60

Supplemental benefits per hour:

1st	2nd	3rd
$ 13.89	$ 14.28	$ 18.73

5-3TF - Z4

Mason - Tile Setter — 05/01/2025

JOB DESCRIPTION Mason - Tile Setter **DISTRICT** 5

ENTIRE COUNTIES
Broome, Chemung, Chenango, Cortland, Delaware, Otsego, Schuyler, Steuben, Tioga, Tompkins

PARTIAL COUNTIES
Allegany: Towns of Alfred, Almond, Andover and Burns.

WAGES
Wages
Per Hour: 07/01/2024
Building:
Marble, Slate, Terrazzo and Tile Setter $ 34.24

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman $ 25.01

OVERTIME PAY
See (B,E,E2*,Q) on OVERTIME PAGE
*Note - Or other conditions beyond the employer's control such as fire or natural disaster.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:

One year terms at the following wage:

1st	2nd	3rd	4th
$ 20.54	$ 23.97	$ 27.39	$ 30.82

Supplemental benefits per hour:

1st	2nd	3rd	4th
$ 14.36	$ 14.82	$ 24.06	$ 24.53

5-3TS - Z4

Millwright — 05/01/2025

JOB DESCRIPTION Millwright **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

WAGES
THE FOLLOWING RATE APPLIES TO ANY GAS/STEAM TURBINE AND OR RELATED COMPONENT WORK, INCLUDING NEW INSTALLATIONS OR MAINTENANCE AND ANY/ALL WORK PERFORMED WITHIN THE PROPERTY LIMITS OF A NUCLEAR FACILITY.

Per hour:	07/01/2024	07/01/2025 Additional
Millwright - Power Generation	$ 45.00	$2.50*

* To be allocated at a later date.

NOTE: ADDITIONAL PREMIUMS PAID FOR THE FOLLOWING WORK LISTED BELOW (amount subject to any overtime premiums):
- Certified Welders shall receive an additional $1.75 per hour provided they are directed to perform Certified Welding.
- If a work site has been declared a hazardous site by the Owner and the use of protective gear (including, as a minimum, air purifying canister-type chemical respirators) is required, then that employee shall receive an additional $1.50 per hour.
- An employee performing the work of a machinist shall receive an additional $2.00 per hour. For the purposes of this premium to apply, a "machinist" is a person who uses a lathe, Bridgeport, milling machine or similar type of tool to make or modify parts.
- When performing work underground at 500 feet and below, the employee shall receive an additional $1.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour paid:

Journeyworker	$ 27.95*

*NOTE: Subject to OT premium

OVERTIME PAY
See (B, E, E2, Q, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: Any holiday that falls on Sunday shall be observed the following Monday. Any holiday that falls on Saturday shall be observed the preceding Friday.

REGISTERED APPRENTICES
WAGES per hour: One year terms at the following percentage of Journeyworker's wage:

Appr. 1st year	65 %*
Appr. 2nd year	75 %*
Appr. 3rd year	80 %*
Appr. 4th year	90 %*

*NOTE: Additional premium for the following work listed below:

Certified Welder	$ 1.75
Hazardous Waste Work	1.50
Machinist	2.00
Underground (500' and below)	1.00

SUPPLEMENTAL BENEFITS per hour:

Appr. 1st year	$ 11.89
Appr. 2nd year	23.14
Appr. 3rd year	24.74
Appr. 4th year	26.35

6-1163Power

Millwright **05/01/2025**

JOB DESCRIPTION Millwright **DISTRICT** 6

ENTIRE COUNTIES
Chemung, Cortland, Livingston, Monroe, Ontario, Orleans, Schuyler, Steuben, Tompkins, Wayne, Wyoming

WAGES

Per hour:	07/01/2024	07/01/2025 Additional

Building	$ 36.20	$ 2.25*
Heavy & Highway	39.70	2.25*

* To be allocated at a later date.

NOTE: ADDITIONAL PREMIUMS PAID FOR THE FOLLOWING WORK LISTED BELOW (amount subject to any overtime premiums):
- Certified Welders shall receive an additional $1.75 per hour provided they are directed to perform Certified Welding.
- On Building projects, If a work site has been declared a hazardous site by the Owner and the use of protective gear (including, as a minimum, air purifying canister-type chemical respirators) is required, then that employee shall receive an additional $1.50 per hour.
- H/H work performed on hazardous waste sites where employees are required to wear protective gear shall receive an additional $2.00 per hour over the Millwright H/H rate for all hours worked on the day protective gear was worn.
- An employee performing the work of a machinist shall receive an additional $2.00 per hour. For the purposes of this premium to apply, a "machinist" is a person who uses a lathe, Bridgeport, milling machine or similar type of tool to make or modify parts.
- When performing work underground at 500 feet and below, the employee shall receive an additional $1.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 26.73

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: Any holiday that falls on Sunday shall be observed the following Monday. Any holiday that falls on Saturday shall be observed the preceding Friday.

REGISTERED APPRENTICES
WAGES per hour: One year terms at the following percentage of Journeyworker's wage:

Appr. 1st year	65 %*
Appr. 2nd year	75 %*
Appr. 3rd year	80 %*
Appr. 4th year	90 %*

*NOTE: Additional premium for the following work listed below:

Certified Welder	$ 1.75
Hazardous Waste (Bldg)	1.50
Hazardous Waste (H/H)	2.00
Machinist	2.00
Underground (500' and below)	1.00

SUPPLEMENTAL BENEFITS per hour:

Appr. 1st year	$ 11.89
Appr. 2nd year	22.28
Appr. 3rd year	23.76
Appr. 4th year	25.25

6-1163

Operating Engineer - Building — 05/01/2025

JOB DESCRIPTION Operating Engineer - Building **DISTRICT** 6

ENTIRE COUNTIES
Cayuga, Cortland, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Seneca, St. Lawrence, Tompkins

WAGES
NOTE:
---If a prime contract is let for site work only, meaning no buildings are involved in their site contract, the Heavy/Highway rates would be applicable. When a prime contract is let for site work and building excavation is part of that contract, the Building rates would be applicable for the Operators classification.
---In the event that equipment listed below is operated by robotic control, the classification covering the operation will be the same as if manually operated.
---If a second employee is required by the employer for operation of any covered machine, they shall be an Engineer Class C.

CLASS A1*: All Cranes (A1 Includes Boom Trucks over 5 tons, Cableway, Cherry Picker, Derrick, Dragline, Dredge, Overhead Crane, Pile Driver, Tower Crane**, Truck Crane, Whirlies).

CLASS A: Air Plako, Asphalt & Blacktop Roller, Automated Concrete Spreader (CMI or equivalent), Automated Fine Grade Machine (CMI), Backhoe, Barrel Shredder, Belt Placer, Blacktop Spreader (such as Barber-Greene & Blaw Knox), Blacktop Plant (automated), Blast or Rotary Drill (Truck or Cat mounted), Boom Trucks 5 ton and under, Burning Plant Operator, Caisson Auger, Central Mix Plant (automated), Concrete Pump, Crusher (Rock), De-watering Press, Diesel Power Unit, Dirt Filter Press with Operation Equipment, Dredge, Dual Drum Paver, Elevating Grader (self-propelled or towed), Elevator Hoist - Two Cage, Excavator - all purpose hydraulically operated, Fork Lift (Loed/Lull and other rough terrain type), Front End Loader (4 c.y. and over), Gradall, Grader (Power), Head Tower (Saurman or equal), Hoist (2 or 3 Drum), Hydroblaster (Laser Pump), Light Plants - Compressors and Generators, Locomotive, Maintenance Engineer, Maintenance Welder, Mine Hoist, Mucking Machine or Mole, Quarry Master or Equivalent, Refrigeration Equipment (for soil stabilization), Scraper, Sea Mule, Shovel, Side Boom, Slip Form Paver, Straddle Buggy (Ross Carrier, Lumber Carrier), Tractor Drawn Belt Type Loader (Euclid Loader), Trenching Machine (digging capacity of over 4ft. depth), Truck or Trailer Mounted Log Chipper (self-feeder), Tug Operator (Manned, rented equipment excluded), Tunnel Shovel, Vibro or Sonic Hammer Controls (when not mounted in proximity to Rig Operator), Work Boat Operator including LCM's.

CLASS B: "A" Frame Truck, Back Dumps, Blacktop Plant (non-automatic), Boring Machine, Bulldozer, Cage-Hoist, Central Mix Plant (non-automated), Compressor, Pump, Generator or Welding machine (when used in battery of not more than five (5)), Concrete Paver (single drum over 16'), Core boring machine, Drill Rigs - tractor mounted, Elevator - as material hoist, Farm Tractor (with or without accessories), Fork Lift (over 10 ton with or without attachments), Front End Loader (under 4 c.y.), Grout Pump, Gunite Machine, High Pressure Boiler (15 lbs. & over), Hoist (one drum), Hydraulic Breaking Hammer (Drop Hammer), Kolman Plant Loader (screening gravel), Maintenance Grease Man, Mixer for stabilized base - self-propelled (Seaman Mixer), Monorail Machine, Parapet Concrete or Pavement Grinder, Parts Man, Post Driver (truck or tractor mounted), Post Hole Digger (truck or tractor mounted), Power Sweeper (Wayne or similar), Pump-Crete or Squeeze-Crete, Road Widener (front end of Grader or self-propelled), Roller, Self-contained hydraulic bench drill, Shell Winder (motorized), Skid steer (Bobcat type loader), Snorkel (overhead arms), Snowblower control man, Tractor (with or without accessories), Trenching Machine (digging capacity of 4 ft. or less), Tugger Hoist, Vacuum Machine (self-propelled or mounted), Vibro Tamp, Well Drill / Well Point System (Submersible pumps when used in lieu of Well Point System), Winch (Motor driven), Winch Cat, Winch Truck.

CLASS C: Compressor (up to 500 cfm), Concrete Paver or Mixer (under 16'), Concrete Pavement Spreaders & Finishers (not automated), Conveyor (over 12 ft), Electric Submersible Pump (4" and over), Fine Grade Machine (not automated), Fireman, Fork Lift ("with or without" attachments, 10 ton and under), Form Tamper, Generator (2,500 watts and over), Hydraulic Pump, Mechanical Heaters (More than two (2) Mechanical Heaters or any Mechanical Heater or Heaters whose combined output exceeds 640,000 BTU per hour (manufacturer's rating) plus one self-contained heating unit - i.e. Sundog or Air Heat type - New Holland Hay Dryer type excluded), Mulching Machine, Oiler, Power Driven Welding Machine (300 amp and over, other than all electric. One Welding Machine under 300 amp will not require an engineer unless in a battery), Power Heaterman (hay dryer), Pumps (water and trash), Revinus Widener (road widener), Single Light Plant, Steam Cleaner or Jenny.

Per hour: Building	07/01/2024	07/01/2025
Class A1*	$ 47.62	$ 49.61
Class A	46.12	48.11
Class B	44.00	45.99
Class C	39.78	41.77

Additional $2.50 per hour if work requires Personal Protective Equipment for hazardous waste site activities with a level C or over rating.

(*) TONNAGE PREMIUMS:
All cranes up to 64 ton capacity - A1 rate
All cranes 65 ton to 110 ton capacity - A1 rate plus $ 1.50
All cranes 111 ton to 199 ton capacity - A1 rate plus $ 2.00
All cranes 200 ton to 399 ton capacity - A1 rate plus $ 3.00
All cranes 400 ton to 599 ton capacity - A1 rate plus $ 4.00
All cranes 600 ton to 799 ton capacity - A1 rate plus $ 5.00
All cranes 800 ton to 999 ton capacity - A1 rate plus $ 6.00
All cranes 1000 ton capacity and over - A1 rate plus $ 7.00

(**) Tower Cranes - A1 rate plus $2.50 (no tonnage premiums apply)

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 31.02	$ 32.12

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: If the holiday falls on Sunday, it will be celebrated on Monday.

REGISTERED APPRENTICES
WAGES per hour: One thousand hour terms at the following percentage of Journeyworker's CLASS A wage:

1st year	60%
2nd year	65%
3rd year	70%
4th year	80%

Additional $2.50 per hour if work requires Personal Protective Equipment for hazardous waste site activities with a level C or over rating.

SUPPLEMENTAL BENEFITS per hour:

	07/01/2024	07/01/2025
All Terms:	$ 30.95	$ 32.05

6-158-545b.s

Operating Engineer - Heavy&Highway — 05/01/2025

JOB DESCRIPTION Operating Engineer - Heavy&Highway **DISTRICT** 6

ENTIRE COUNTIES
Cayuga, Cortland, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Seneca, St. Lawrence, Tompkins

WAGES
NOTE:
---In the event that equipment listed below is operated by robotic control, the classification covering the operation will be the same as if manually operated.
---If a second employee is required by the employer for operation of any covered machine, they shall be an Engineer Class C.

CLASS A1*: All Cranes that require a NYS Crane License (Boom Truck, Cherry Picker, Derrick, Dragline, Overhead Crane (Gantry or Straddle Type), Pile Driver, Tower Cranes (including self erecting)**, Truck Crane).

CLASS A: Asphalt Curb Machine (self-propelled, slipform); Asphalt Paver; Automated Concrete Spreader (CMI type); Automatic Fine Grader; Backhoe (except tractor mounted, rubber tired); Backhoe Excavator, Full Swing (CAT 212 or similar type); Back Filling Machine; Belt Placer (CMI type); Blacktop Plant (automated);Blacktop Roller; Bull Dozer being operated with active GPS; Cableway; Caisson Auger; Central Mix Concrete Plant (automated); Concrete Curb Machine (self-propelled, slipform); Concrete Pump; Cranes - listed in A1 that do not require a NYS Crane License; Directional Boring/Drilling Machine; Dredge; Dual Drum Paver; Excavator (all purpose-hydraulic, Gradall or similar); Front End Loader (4 cu. yd. & over); Head Tower (Sauerman or equal); Hoist (two or three drum); Holland Loader; Maintenance Engineer; Mine Hoist; Mucking Machine or Mole; Pavement Breaker (SP Wertgen; PB-4 and similar type); Profiler/Milling Machine (over 105 h.p.); Power Grader; Quad 9; Quarry Master (or equivalent); Rotating Telehandler; Scraper (including challenger type); Shovel; Side Boom; Slip Form Paver; Tractor Drawn Belt-Type Loader; Truck or Trailer Mounted Chipper (self-feeder); Tug Operator (manned rented equipment excluded); Tunnel Shovel.

CLASS B: Backhoe (tractor mounted, rubber tired); Bituminous Recycler Machine; Bituminous Spreader and Mixer; Blacktop Plant (non-automated); Blast or Rotary Drill (truck or tractor mounted); Boring Machine; Bridge Deck Finishing Machine; Brokk; Cage Hoist; Central Mix Plant (non-automated) and All Concrete Batching Plants; Concrete Paver (over 16'); Crawler Drill (self-contained); Crusher; Diesel Power Unit; Drill Rigs (truck or tractor mounted); Front End Loader (under 4 cu. yd.); Greaseman - Lubrication Engineer; HiPressure Boiler (15 lbs & over); Hoist (one drum); Hydro-Axe; Kolman Plant Loader & similar type loaders; Locomotive; Material Handling Knuckle Boom; Mini Excavators (under 18,000 lbs.); Mixer (for stabilized base, self-propelled); Monorail Machine; Profiler/Milling Machine (105 h.p. and under); Plant Engineer; Prentice Loader; Pug Mill; Pump Crete; Ready Mix Concrete Plant; Refrigeration Equipment (for soil stabilization); Road Widener; Roller (all above subgrade, See Class A for Blacktop Roller); Sea Mule; Self-contained ride-on Rock Drill (excluding Air-Track type drill); Skidder; Tractor with Dozer and/or Pusher; Trencher; Tugger Hoist; Vacuum Machine (mounted or towed); Vermeer Saws (ride-on, any size or type); Welder; Winch and Winch Cat; Work Boat Operator including L.C.M.'s.

CLASS C: "A" Frame Winch Hoist (On Truck); Aggregate Plant; Articulated Heavy Hauler; Asphalt or Concrete Grooving Machine (ride-on); Ballast Regulator (ride-on); Bituminous Heater (self-propelled); Boat (powered); Boiler (used in conjunction with production); Cement & Bin Operator; Compressors***; Concrete Pavement Spreader and Finisher; Concrete Paver or Mixer (16' & under); Concrete Saw (self-propelled); Conveyor; Deck Hand; Directional Boring/Drilling Machine Locator; Drill (Core); Drill (Well); Dust Collectors***; Electric Pump When Used in Conjunction with Well Point System; Farm Tractor with accessories; Fine Grade Machine; Fireman; Fork Lift; Form Tamper; Generators***; Grout Pump; Gunite Machine; Hammers (hydraulic self-propelled); Heaters***; Hydra-Spiker (ride-on); Hydraulic Pump (jacking system); Hydro-Blaster (water); Light Plants***; Mulching Machine; Oiler; Parapet Concrete or Pavement Grinder; Post Hole Digger (excluding hand-held); Post Driver; Power Broom (towed); Power Heaterman; Power Sweeper; Pumps***; Revinius Widener; Roller (subgrade & fill); Scarifier (ride-on); Shell Winder; Skid Steer Loader (Bobcat or similar, including all attachments); Span Saw (ride-on); Steam Cleaner; Tamper (ride-on); Tie Extractor (ride-on); Tie Handlers (ride-on); Tie Inserters (ride-on); Tie Spacers (ride-on); Tire Repair; Track Liner (ride-on); Tractor; Tractor (with towed accessories); Vacuum Machine (self-propelled); Vibratory Compactor; Vibro Tamp; Welding Machines***; Well Point.

***CLASS C NOTE: Considered Hands-Off (unmanned). Includes only operation and maintenance of the equipment.

Per hour: H/H	07/01/2024	07/01/2025
CLASS A1*	$ 56.51	$ 58.85
CLASS A	53.51	55.85
CLASS B	52.63	54.97
CLASS C	49.35	51.69

(*) TONNAGE PREMIUMS:
All cranes up to 64 ton capacity - A1 rate
All cranes 65 ton to 110 ton capacity - A1 rate plus $ 1.50
All cranes 111 ton to 199 ton capacity- A1 rate plus $ 2.00
All cranes 200 ton to 399 ton capacity - A1 rate plus $ 3.00
All cranes 400 ton to 599 ton capacity - A1 rate plus $ 4.00
All cranes 600 ton to 799 ton capacity - A1 rate plus $ 5.00
All cranes 800 ton to 999 ton capacity - A1 rate plus $ 6.00
All cranes 1000 ton capacity and over - A1 rate plus $ 7.00

(**) Tower Cranes - A1 rate plus $3.00 (no tonnage premiums apply)

- Cranes in Luffer Configuration - A1 rate plus $ 5.00
- Cranes with external ballast (Tray or Wagon) - A1 rate plus $ 5.00

Additional $2.50 per hour for hazardous waste removal work on a State and/or Federally designated waste site which requires employees to wear Level C or above forms of personal protection.

SHIFT WORK
SINGLE IRREGULAR WORK SHIFT: Additional $2.50 per hour for all employees who work a single irregular work shift starting from 5:00 PM to 1:00 AM that is mandated by the Contracting Agency.

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2024	07/01/2025
Journeyworker	$ 32.45	$ 33.55

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: If a holiday falls on Sunday, it will be celebrated on Monday. If an employee works on this Monday, they shall be compensated at double time plus the holiday pay (triple time). If a holiday falls on a Saturday, employees who work a Saturday Holiday shall be paid double time plus the holiday pay.

REGISTERED APPRENTICES
WAGES per hour: One thousand hour terms at the following percentage of Journeyworker's CLASS B wage.

1st term	60%
2nd term	70%
3rd term	80%
4th Term	90%

Additional $2.50 per hour for hazardous waste removal work on a State and/or Federally designated waste site which requires employees to wear Level C or above forms of personal protection.

SUPPLEMENTAL BENEFITS per hour: Same as Journeyworker

6-158-545h

Operating Engineer - Survey Crew — 05/01/2025

JOB DESCRIPTION Operating Engineer - Survey Crew **DISTRICT** 12

ENTIRE COUNTIES
Albany, Allegany, Broome, Cayuga, Chemung, Chenango, Clinton, Columbia, Cortland, Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Oneida, Onondaga, Ontario, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Warren, Washington, Wayne, Yates

PARTIAL COUNTIES
Dutchess: The northern portion of the county from the northern boundary line of the City of Poughkeepsie, north.
Genesee: Only the portion of the county that lies east of a line down the center of Route 98 to include all area that lies within the City of Batavia.

WAGES
These rates apply to Building, Tunnel and Heavy Highway.

Per hour:
SURVEY CLASSIFICATIONS:

Party Chief - One who directs a survey party.
Instrument Person - One who operates the surveying instruments.
Rod Person - One who holds the rods and assists the Instrument Person.

	07/01/2024
Party Chief	$ 50,65
Instrument Person	46.54
Rod Person	34.55

Additional $3.00/hr. for Tunnel Work
Additional $2.50/hr. for Hazardous Work Site

SUPPLEMENTAL BENEFITS
Per hour worked:

Journeyman	$ 29.75

OVERTIME PAY
See (B, E, P, *X) on OVERTIME PAGE
*Note: $25.10/Hr. Only for "ALL" premium hours paid when worked.

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES: 1000 hour terms based on the Percentage of Rod Persons Wage:

	07/01/2024
0-1000	60%
1001-2000	70%
2001-3000	80%

SUPPLEMENTAL BENEFIT per hour worked:

0-1000	$ 21.53 / PHP $18.45
1001-2000	24.55 / " 20.45
2001-3000	27.58/ " 22.93

NOTE: PHP is premium hours paid when worked.

12-158-545 D.H.H.

Operating Engineer - Survey Crew - Consulting Engineer — 05/01/2025

JOB DESCRIPTION Operating Engineer - Survey Crew - Consulting Engineer **DISTRICT** 12

ENTIRE COUNTIES
Albany, Allegany, Broome, Cayuga, Chemung, Chenango, Clinton, Columbia, Cortland, Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Oneida, Onondaga, Ontario, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Warren, Washington, Wayne, Yates

PARTIAL COUNTIES
Dutchess: The northern portion of the county from the northern boundary line of the City of Poughkeepsie, north.
Genesee: Only the portion of the county that lies east of a line down the center of Route 98 to include all area that lies within the City of Batavia.

WAGES
These rates apply to feasibility and preliminary design surveying, line and grade surveying for inspection or supervision of construction when performed under a Consulting Engineer Agreement.

Per hour:
SURVEY CLASSIFICATIONS:

Party Chief - One who directs a survey party.
Instrument Person - One who operates the surveying instruments.
Rod Person - One who holds the rods and assists the Instrument Person.

	07/01/2024
Party Chief	$ 50.65
Instrument Person	46.54
Rod Person	34.55

Additional $3.00/hr. for Tunnel Work.
Additional $2.50/hr. for EPA or DEC certified toxic or hazardous waste work.

SUPPLEMENTAL BENEFITS
Per hour worked:

Journeyman	$ 29.75

OVERTIME PAY
See (B, E, Q, *X) on OVERTIME PAGE
*Note: $25.10/Hr. Only for "ALL" premium hours paid when worked.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES: 1000 hour terms based on percentage of Rod Persons Wage:

	07/01/2024
0-1000	60%
1001-2000	70%
2001-3000	80%

SUPPLEMENTAL BENEFIT per hour worked:

0-1000	$ 21.53 / PHP	$18.45
1001-2000	$ 24.55 / "	20.45
2001-3000	$ 26.98 / "	22.93

NOTE: PHP is premium hours paid when worked.

12-158-545 DCE

Operating Engineer - Tunnel — 05/01/2025

JOB DESCRIPTION Operating Engineer - Tunnel **DISTRICT** 7

ENTIRE COUNTIES
Albany, Allegany, Broome, Cayuga, Chemung, Chenango, Clinton, Columbia, Cortland, Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Oneida, Onondaga, Ontario, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Warren, Washington, Wayne, Yates

PARTIAL COUNTIES
Dutchess: Northern part of Dutchess, to the northern boundary line of the City of Poughkeepie, then due east to Route 115 to Bedell Road, then east along Bedell Road to VanWagner Road, then north along VanWagner Road to Bower Road, then east along Bower Road to Rte. 44 east to Rte. 343, then along Rte. 343 east to the northern boundary of the Town of Dover Plains and east along the northern boundary of the Town of Dover Plains, to the borderline of the State of Connecticut.
Genesee: Only that portion of the county that lies east of a line drawn down the center of Route 98 and the entirety of the City of Batavia.

WAGES
CLASS A: Automatic Concrete Spreader (CMI Type); Automatic Fine Grader; Backhoe (except tractor mounted, rubber tired); Belt Placer (CMI Type); Blacktop Plant (automated); Cableway; Caisson Auger; Central Mix Concrete Plant (automated); Concrete Curb Machine (self-propelled slipform); Concrete Pump (8" or over); Dredge; Dual Drum Paver; Excavator; Front End Loader (4 cu. yd & over); Gradall; Head Tower (Sauerman or Equal); Hoist (shaft); Hoist (two or three Drum); Log Chipper/Loader (self-feeder); Maintenance Engineer (shaft and tunnel); any Mechanical Shaft Drill; Mine Hoist; Mining Machine(Mole and similar types); Mucking Machine or Mole; Overhead Crane (Gantry or Straddle Type); Pile Driver; Power Grader; Remote Controlled Mole or Tunnel Machine; Scraper; Shovel; Side Boom; Slip Form Paver (If a second man is needed, they shall be an Oiler); Tripper/Maintenance Engineer (shaft & tunnel); Tractor Drawn Belt-Type Loader; Tug Operator (manned rented equipment excluded); Tunnel Shovel.

CLASS B: Automated Central Mix Concrete Plant; Backhoe (topside); Backhoe (track mounted, rubber tired); Backhoe (topside); Bituminous Spreader and Mixer, Blacktop Plant (non-automated); Blast or Rotary Drill (truck or tractor mounted); Boring Machine; Cage Hoist; Central Mix Plant(non-automated); all Concrete Batching Plants; Compressors (4 or less exceeding 2,000 c.f.m. combined capacity); Concrete Pump; Crusher; Diesel Power Unit; Drill Rigs (tractor mounted); Front End Loader (under 4 cu. yd.); Grayco Epoxy Machine; Hoist (One Drum); Hoist (2 or 3 drum topside); Knuckle Boom material handler; Kolman Plant Loader & similar type Loaders (if employer requires another person to clean the screen or to maintain the equipment, they shall be an Oiler); L.C.M. Work Boat Operator; Locomotive; Maintenance Engineer (topside); Maintenance Grease Man; Mixer (for stabilized base-self-propelled); Monorail Machine; Plant Engineer; Personnel Hoist; Pump Crete; Ready Mix Concrete Plant; Refrigeration Equipment (for soil stabilization); Road Widener; Roller (all above sub-grade); Sea Mule; Shotcrete Machine; Shovel (topside); Tractor with Dozer and/or Pusher; Trencher; Tugger Hoist; Tunnel Locomotive; Vacuum Machine (mounted or towed); Welder; Winch; Winch Cat.

CLASS C: A Frame Truck; All Terrain Telescoping Material Handler; Ballast Regulator (ride-on); Compressors (4 not to exceed 2,000 c.f.m. combined capacity; or 3 or less with more than 1200 c.f.m. but not to exceed 2,000 c.f.m.); Compressors ((any size, but subject to other provisions for compressors), Dust Collectors, Generators, Pumps, Welding Machines, Light Plants (4 or any type combination)); Concrete Pavement Spreaders and Finishers; Conveyor; Drill (core); Drill (well); Electric Pump used in conjunction with Well Point System; Farm Tractor with Accessories; Fine Grade Machine; Fork Lift; Grout Pump (over 5 cu. ft.); Gunite Machine; Hammers (hydraulic-self-propelled); Hydra-Spiker (ride-on); Hydra-Blaster (water); Hydro-Blaster; Motorized Form Carrier; Post Hole Digger and Post Driver; Power Sweeper; Roller grade & fill); Scarifer (ride-on); Span-Saw (ride-on); Submersible Electric Pump (when used in lieu of well points); Tamper (ride-on); Tie-Extractor (ride-on), Tie Handler (ride-on), Tie Inserter (ride-on), Tie Spacer (ride-on); Track Liner (ride-on); Tractor with towed accessories; Vibratory Compactor; Vibro Tamp, Well Point.

CLASS D: Aggregate Plant; Cement & Bin Operator; Compressors (3 or less not to exceed 1,200 c.f.m. combined capacity); Compressors ((any size, but subject to other provisions for compressors), Dust Collectors, Generators, Pumps, Welding Machines, Light Plants (3 or less or any type or combination)); Concrete Saw (self-propelled); Form Tamper; Greaseman; Hydraulic Pump (jacking system); Junior Engineer; Light Plants; Mulching Machine; Oiler; Parapet Concrete or Pavement Grinder; Power Broom (towed); Power Heaterman (when used for production); Revinius Widener; Shell Winder; Steam Cleaner; Tractor.

Per hour:	07/01/2024	07/01/2025
CLASS A	$ 55.91	$ 58.44
CLASS B	54.69	57.22
CLASS C	51.90	54.43
CLASS D	48.89	51.42

Additional $5.00 per hour for Hazardous Waste Work on a state or federally designated hazardous waste site where the Operating Engineer is in direct contact with hazardous material and when personal protective equipment is required for respiratory, skin and eye protection.

CRANES:
Crane 1: All cranes, including self-erecting.
Crane 2: All Lattice Boom Cranes and all cranes with a manufacturer's rating of fifty (50) ton and over.
Crane 3: All hydraulic cranes and derricks with a manufacturer's rating of forty nine (49) ton and below, including boom trucks.

Crane 1	$ 59.91	$ 62.44
Crane 2	58.91	61.44
Crane 3	57.91	60.44

SUPPLEMENTAL BENEFITS

Per hour:		
	$ 25.05	$ 25.90
	+ 9.85*	+ 10.10*

* This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY
See (B, B2, E, Q, X) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: If a holiday falls on Sunday, it shall be observed on Monday.

REGISTERED APPRENTICES
WAGES:(1000) hours terms at the following percentage of Journeyworker's Class B wage.

1st term	60%
2nd term	65%
3rd term	70%
4th term	75%

SUPPLEMENTAL BENEFITS per hour: Same as Journeyworker

7-158-832TL.

Painter **05/01/2025**

JOB DESCRIPTION Painter **DISTRICT** 2

ENTIRE COUNTIES
Cortland, Tompkins

WAGES
Per hour:

	07/01/2024	05/01/2025	05/01/2026 Additional
Painter	$ 27.50	$ 28.20	$ 1.85*
Taper, Paperhangers, and Vinyl hangers	28.88	29.61	1.90*

*To be allocated at a later date.

ADDITIONAL AMOUNTS FOR SPECIFIC TYPES OF JOBSITE CONDITIONS (amount subject to any overtime premiums):
- Additional $ 1.10 per hour for Brush and Roll Epoxy (Solvent Base Only)
- Additional $ 0.60 per hour for Swing Scaffold, Boatswain chair, Spray helper, Steam cleaning acid and high pressure water, Power grinders with respirator
- Additional $ 0.60 per hour for Structural steel (buildings) defined as new or old construction where ceilings, walls or the steel itself is to be painted from open trusses which require climbing or crawling without the support of solid scaffolding or scaffolding starting at the floor or ground level.
- Additional $ 1.00 per hour for Spray Painting
- Additional $ 1.00 per hour for Steeple Jack (Over 100 feet)
- Additional $ 1.50 per hour for Spray Epoxy (Solvent Based)
- Additional $ 0.90 per hour for Sandblasting

NOTE - SEE BRIDGE PAINTER RATES FOR BRIDGES & TANKS

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 24.08	$ 24.98

OVERTIME PAY
See (B, E2, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
A Holiday that falls on a Sunday will be celebrated on Monday, a holiday that falls on a Saturday will be celebrated on Friday.

REGISTERED APPRENTICES
WAGES:

Painter: 750 hour terms at the Painter Apprentice wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th
$ 18.00	$ 19.00	$ 20.00	$ 21.00	$ 22.00	$ 23.00	$ 24.00	$ 25.00

Taper: 750 hour terms at the following Journeyworker Taper Apprentice wage rate:

1st	2nd	3rd	4th	5th	6th
$ 20.00	$ 21.00	$ 22.00	$ 23.00	$ 24.00	$ 25.00

ADDITIONAL AMOUNTS FOR SPECIFIC TYPES OF JOBSITE CONDITIONS (amount subject to any overtime premiums):
- Additional $ 1.10 per hour for Brush and Roll Epoxy (Solvent Base Only)
- Additional $ 0.60 per hour for Swing Scaffold, Boatswain chair, Spray helper, Steam cleaning acid and high pressure water, Power grinders with respirator
- Additional $ 0.60 per hour for Structural steel (buildings) defined as new or old construction where ceilings, walls or the steel itself is to be painted from open trusses which require climbing or crawling without the support of solid scaffolding or scaffolding starting at the floor or ground level.
- Additional $ 1.00 per hour for Spray Painting
- Additional $ 1.00 per hour for Steeple Jack (Over 100 feet)
- Additional $ 1.50 per hour for Spray Epoxy (Solvent Based)
- Additional $ 0.90 per hour for Sandblasting

SUPPLEMENTAL BENEFITS per hour:
Painter/Decorator:

1st	2nd	3rd	4th	5th	6th	7th	8th
$ 6.00	$ 7.00	$ 8.00	$ 9.10	$ 11.00	$ 11.00	$ 13.00	$ 14.00

Taper/Drywall Finisher:

1st	2nd	3rd	4th	5th	6th
$ 6.00	$ 7.00	$ 8.00	$ 10.00	$ 13.00	$ 14.00

2-178 I

Painter 05/01/2025

JOB DESCRIPTION Painter **DISTRICT** 3

ENTIRE COUNTIES
Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Cortland, Delaware, Erie, Genesee, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Wayne, Wyoming, Yates

WAGES

Per hour:	07/01/2024	05/01/2025 Additional	05/01/2026 Additional
Bridge	$ 43.81	$ 2.50	$ 2.50
Tunnel	43.81		
Tank*	41.81		

For Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

Tank rate applies to indoor and outdoor tanks, tank towers, standpipes, digesters, waste water treatment tanks, chlorinator tanks, etc. Covers all types of tanks including but not limited to steel tanks, concrete tanks, fiberglass tanks, etc.

SHIFT WORK
Note an additional $1.50 per hour is required when the contracting agency or project specification requires any shift to start prior to 6:00am or after 12:00 noon.

SUPPLEMENTAL BENEFITS
Per hour:
$ 31.39

OVERTIME PAY
Exterior work only See (B, E4, F*, R) on OVERTIME PAGE.
All other work See (B, F*, R) on OVERTIME PAGE.
*Note - Saturday is payable at straight time if the employee misses work, except where a doctor's or hospital verification of illness is produced Monday through Friday when work was available to the employee.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following wage:

1st	2nd	3rd	4th	5th	6th
$ 24.00	$ 26.00	$ 28.00	$ 30.00	$ 34.00	$ 38.00

Supplemental benefits per hour:

1st	2nd	3rd	4th	5th	6th
$ 6.60	$ 6.95	$ 7.30	$ 7.65	$ 8.00	$ 8.35

3-4-Bridge, Tunnel, Tank

Painter - Metal Polisher 05/01/2025

JOB DESCRIPTION Painter - Metal Polisher **DISTRICT** 8

ENTIRE COUNTIES
Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

	07/01/2024
Metal Polisher	$ 39.33
Metal Polisher*	40.43
Metal Polisher**	43.33

*Note: Applies on New Construction & complete renovation

** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2024
Journeyworker:	
All classification	$ 12.79

OVERTIME PAY
See (B, E, P, T) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year term at the following wage rates:

	07/01/2024
1st year	$ 19.67
2nd year	21.63
3rd year	23.60
1st year*	$ 22.06
2nd year*	22.07
3rd year*	24.14
1st year**	$ 22.17
2nd year**	24.13
3rd year**	26.10

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:
Per hour:

1st year	$ 8.69
2nd year	8.69
3rd year	8.69

8-8A/28A-MP

Plumber — 05/01/2025

JOB DESCRIPTION Plumber **DISTRICT** 6

ENTIRE COUNTIES
Chemung, Cortland, Onondaga, Schuyler, Tompkins

PARTIAL COUNTIES
Madison: Only the Townships of Sullivan, Cazenovia and DeRuyter.
Seneca: Only the Townships of Covert and Lodi.
Steuben: Only the Townships of Addison, Bath, Bradford, Campbell, Caton, Corning, Erwin, Hornby, Lindley, Pulteney, Rathbone, Thurston, Tuscarora, Urbana and Wayne.
Tioga: Only the Townships of Barton, Berkshire, Candor, Nichols, Richford, Spencer and Tioga.

WAGES

Per hour:	07/01/2024	05/01/2025 Additional	05/01/2026 Additional
Plumber, Steamfitter, Pipefitter, Welder, HVAC, Refrigeration.	$ 45.11	$ 4.25*	$ 4.50*

*To be allocated at a later date.

SHIFT WORK
SINGLE IRREGULAR WORK SHIFT: Additional 15% premium added to the wages above for a single irregular work shift outside of normal working hours.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 27.05*

*NOTE: $10.27 of the supplemental benefits are paid at the same premium as shown for overtime work performed at semi-conductor manufacturer and/or fabrication plants.

OVERTIME PAY
Time and one half for the 9th & 10th hours Monday thru Friday and first 10 hours on Saturday. All other overtime hours are double-time.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
NOTE: If a holiday falls on Saturday, the holiday will be observed on the preceding Friday. If a holiday falls on Sunday, it will be observed on the following Monday.

REGISTERED APPRENTICES
WAGES per hour: One year terms at the following percentage of the Journeyworker's wage:

1st	2nd	3rd	4th	5th
55%	60%	70%	75%	85%

SUPPLEMENTAL BENEFITS per hour*:

1st	$ 15.13
2nd	23.89
3rd	24.44
4th	24.99
5th	25.92

*NOTE: Below is the portion of supplemental benefits paid at overtime premiums for work performed at semi-conductor manufacturer and/or fabrication plants:

1st	n/a
2nd	$ 8.58
3rd	$ 8.77
4th	$ 9.14
5th	$ 9.71

6-81-SF

Roofer — 05/01/2025

JOB DESCRIPTION Roofer **DISTRICT** 2

ENTIRE COUNTIES
Broome, Chemung, Chenango, Delaware, Otsego, Schoharie, Schuyler, Steuben, Tioga, Tompkins

WAGES
Per hour:

	07/01/2024	06/01/2025 Additional
Roofer, Waterproofer	$ 29.61 + 0.99*	$ 2.50**

*This amount is paid for all hours worked, whether regular or premium hours.
**To be allocated at a later date
NOTE ADDITIONAL PREMIUMS PAID FOR THE FOLLOWING WORK LISTED BELOW (amount not subject to overtime premiums):
- On days where more than one shift is worked on the job, the hours worked after 4:30 PM and before 6:30 AM will be paid an additional $1.90 per hour premium. This premium is not for use in emergency repair situations.
- Premium of $1.25 per hour will be paid for the application, rip-off or handling of pitch products. The premium will be paid for pitch that is showing, covered or buried on the roof.
- Premium of $1.25 per hour will be paid for asbestos abatement requiring a half face respirator.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 22.24

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages:
Hours per term

0-667 Hrs.	$ 20.73 + 0.69*
668-1335 Hrs.	22.21 + 0.74*
1336-2002 Hrs.	23.69 + 0.79*
2003-2669 Hrs.	25.17 + 0.84*
2670-3336 Hrs.	26.65 + 0.89*
3337-4000 Hrs.	28.13 + 0.94*

*This amount is paid for all hours worked, whether regular or premium hours.
NOTE ADDITIONAL PREMIUMS PAID FOR THE FOLLOWING WORK LISTED BELOW (amount not subject to overtime premiums):
- On days where more than one shift is worked on the job, the hours worked after 4:30 PM and before 6:30 AM will be paid an additional $1.90 per hour premium. This premium is not for use in emergency repair situations.
- Premium of $1.25 per hour will be paid for the application, rip-off or handling of pitch products. The premium will be paid for pitch that is showing, covered or buried on the roof.
- Premium of $1.25 per hour will be paid for asbestos abatement requiring a half face respirator.

Supplemental Benefits:

0-667 Hrs.	$ 18.56
668-1335 Hrs.	19.18
1336-2002 Hrs.	19.79
2003-2669 Hrs.	20.40
2670-3336 Hrs.	21.02
3337-4000 Hrs.	21.63

2-203elmi

Sheetmetal Worker — 05/01/2025

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 2

ENTIRE COUNTIES
Allegany, Broome, Chemung, Delaware, Otsego, Schuyler, Steuben, Tioga, Tompkins

WAGES
Per hour:

	07/01/2024
Sheetmetal Worker	$ 37.09 + 0.93*
Polyresin Fiberglass	37.19 + 0.93*
CAD Operator	38.09 +0.95*

*Amount is paid for every hour worked (amount not subject to overtime premium)

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker: $ 22.06

OVERTIME PAY
See (*B1, Q) on OVERTIME PAGE
*On Saturday, time and one half of the hourly rate for the first ten (10) hours, then two (2) times the hourly wage rate for all hours after ten (10) hours worked.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
Note: Holidays are observed on the Holiday, not on the day that it is locally observed.

REGISTERED APPRENTICES
WAGES per hour:
Half Year Terms

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2024	22.25 +0.56*	22.25 +0.56*	24.11 +0.60*	25.96 +0.65*	27.82 +0.70*	29.67 +0.74*	31.53 +0.79*	33.38 +0.83*

*Amount is paid for every hour worked (amount not subject to overtime premium)

SUPPLEMENTAL BENEFITS per hour:

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2024	1.78	1.78	18.30	18.38	18.46	18.54	18.62	18.70

2-112

Sprinkler Fitter — 05/01/2025

JOB DESCRIPTION Sprinkler Fitter **DISTRICT** 1

ENTIRE COUNTIES
Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Tioga, Tompkins, Washington, Wayne, Wyoming, Yates

WAGES

Per hour	07/01/2024
Sprinkler Fitter	$ 42.00

SUPPLEMENTAL BENEFITS

Per hour	
Journeyworker	$ 28.82

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
Note: When a holiday falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double time rate. When a holiday falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double time rate.

REGISTERED APPRENTICES
Wages per hour

One Half Year terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 20.03	$ 22.26	$ 24.24	$ 26.46	$ 28.69	$ 30.91	$ 33.14	$ 35.37	$ 37.59	$ 39.82

Supplemental Benefits per hour

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 9.18	$ 9.18	$ 20.90	$ 20.90	$ 21.15	$ 21.15	$ 21.15	$ 21.15	$ 21.15	$ 21.15

1-669

Teamster - Building — 05/01/2025

JOB DESCRIPTION Teamster - Building **DISTRICT** 6

ENTIRE COUNTIES
Broome, Cayuga, Cortland, Delaware, Onondaga, Seneca, Tompkins, Yates

PARTIAL COUNTIES
Allegany: Only the Townships of Almond, Burns, and Alfred.
Chenango: Only the Townships of Afton, Bainbridge, Coventry, Greene, Guilford, Oxford and Smithville.
Madison: Only the Townships of Cazenovia, DeRuyter, Fenner, Georgetown, Lenox, Nelson and Sullivan.
Oswego: All Townships except Redfield, Boylston and Sandy Creek.
Otsego: Only the Townships of Butternuts, Laurens, Maryland, Millford, Morris, Oneonta, Otego, Unadilla, and Worchester.
Steuben: Only the Townships of Prattsburg, Canisteo, Fremont, Cohoctan, Dansville, Hornell, Hartsville, Greenwood, West Union, Troupsburg, and Jasper.
Tioga: Only the Townships of Berkshire, Candor, Newark Valley, Nichols, Owego, Richford, and Tioga. All territory east of Nichols/Smithboro to Broome County, within State of New York.

WAGES
GROUP A: Straight Trucks.
GROUP B: Tractor Trailer, Farm Tractor, Fuel Truck.
GROUP C: Euclid.
GROUP D: On site Mechanic.

Per hour:	07/01/2024	06/01/2025
Building: (under $ 5 million*)		
GROUP A,B,C,D	$ 31.43	$ 34.43
Building: (over $ 5 million*)		
GROUP A,B	$ 32.48	$ 35.48

GROUP C	32.83	35.83
GROUP D	32.63	35.63

* Total project cost including General Construction, Plumbing, HVAC and Electrical

SUPPLEMENTAL BENEFITS
Per hour:

(under $5 million*)	$ 30.02	$ 30.87
(over $5 million*)	30.80	31.67

* Total project cost including General Construction, Plumbing, HVAC and Electrical

OVERTIME PAY
(D, O) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

6-317

Teamster - Heavy&Highway — 05/01/2025

JOB DESCRIPTION Teamster - Heavy&Highway **DISTRICT** 6

ENTIRE COUNTIES
Cayuga, Cortland, Seneca, Tompkins, Yates

PARTIAL COUNTIES
Allegany: Only the Townships of Almond, Alfred, Burns and West Almond.
Steuben: Only the Townships of Canisteo, Cohocton, Dansville, Freemont, Greenwood, Hartsville, Hornell, Jasper, Prattsburg, Troupsburg, and West Union.

WAGES
GROUP 1: Warehousemen*, Yardmen*, Truck Helpers, Pickups, Panel Trucks, Flatboy Material Trucks (straight jobs), Single Axle Dump Trucks, Dumpsters, Material Checkers & Receivers*, Greasers, Truck Tiremen, Mechanics Helpers and Parts Chasers, Tandems & Batch Trucks, Mechanics, Semi-Trailers, Low-boy Trucks, Asphalt Distributor Trucks and Agitator, Mixer Trucks and Dumpcrete type vehicles, Truck Mechanic, Fuel Trucks.

*NOTE: Applies when a temporary warehouse structure is built/utilized specifically for a public work project.

GROUP 2: Specialized Earth Moving Equipment-Euclid type, or similar off-highway equipment, where not self-loading, Straddle (Ross) Carrier, and self-contained concrete mobile truck, Off-highway Tandem Back-Dump, Twin Engine Equipment and Double-Hitched Equipment where not self-loading.

Per hour:	07/01/2024
GROUP 1	$ 34.21
GROUP 2	34.41

SUPPLEMENTAL BENEFITS
Per hour: 07/01/2024

Journeyworker $ 28.85

OVERTIME PAY
See (*B, B2, J) on OVERTIME PAGE
*Time and one half also applicable after the 5th day worked.

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

6-317(Syr)

Welder — 05/01/2025

JOB DESCRIPTION Welder **DISTRICT** 1

ENTIRE COUNTIES
Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour 07/01/2024

Welder: To be paid the same rate of the mechanic performing the work.*

*EXCEPTION: If a specific welder certification is required, then the 'Certified Welder' rate in that trade tag will be paid.

OVERTIME PAY

HOLIDAY

1-As Per Trade

Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

NOTE: Supplemental Benefits are 'Per hour worked' (for each hour worked) unless otherwise noted

(AA)	Time and one half of the hourly rate after 7 and one half hours per day
(A)	Time and one half of the hourly rate after 7 hours per day
(B)	Time and one half of the hourly rate after 8 hours per day
(B1)	Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday. Double the hourly rate for all additional hours
(B2)	Time and one half of the hourly rate after 40 hours per week
(B3)	Time and one half of the hourly rate after 40 straight hours per week
(C)	Double the hourly rate after 7 hours per day
(C1)	Double the hourly rate after 7 and one half hours per day
(D)	Double the hourly rate after 8 hours per day
(D1)	Double the hourly rate after 9 hours per day
(E)	Time and one half of the hourly rate on Saturday
(E1)	Time and one half 1st 4 hours on Saturday; Double the hourly rate all additional Saturday hours
(E2)	Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
(E3)	Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
(E4)	Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
(E5)	Double time after 8 hours on Saturdays
(F)	Time and one half of the hourly rate on Saturday and Sunday
(G)	Time and one half of the hourly rate on Saturday and Holidays
(H)	Time and one half of the hourly rate on Saturday, Sunday, and Holidays
(I)	Time and one half of the hourly rate on Sunday
(J)	Time and one half of the hourly rate on Sunday and Holidays
(K)	Time and one half of the hourly rate on Holidays
(L)	Double the hourly rate on Saturday
(M)	Double the hourly rate on Saturday and Sunday
(N)	Double the hourly rate on Saturday and Holidays
(O)	Double the hourly rate on Saturday, Sunday, and Holidays
(P)	Double the hourly rate on Sunday
(Q)	Double the hourly rate on Sunday and Holidays
(R)	Double the hourly rate on Holidays

(S)	Two and one half times the hourly rate for Holidays
(S1)	Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.
(T)	Triple the hourly rate for Holidays
(U)	Four times the hourly rate for Holidays
(V)	Including benefits at SAME PREMIUM as shown for overtime
(W)	Time and one half for benefits on all overtime hours.
(X)	Benefits payable on Paid Holiday at straight time. If worked, additional benefit amount will be required for worked hours. (Refer to other codes listed.)

Holiday Codes

PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

(1)	None
(2)	Labor Day
(3)	Memorial Day and Labor Day
(4)	Memorial Day and July 4th
(5)	Memorial Day, July 4th, and Labor Day
(6)	New Year's, Thanksgiving, and Christmas
(7)	Lincoln's Birthday, Washington's Birthday, and Veterans Day
(8)	Good Friday
(9)	Lincoln's Birthday
(10)	Washington's Birthday
(11)	Columbus Day
(12)	Election Day
(13)	Presidential Election Day
(14)	1/2 Day on Presidential Election Day
(15)	Veterans Day
(16)	Day after Thanksgiving
(17)	July 4th
(18)	1/2 Day before Christmas
(19)	1/2 Day before New Years
(20)	Thanksgiving
(21)	New Year's Day
(22)	Christmas
(23)	Day before Christmas
(24)	Day before New Year's
(25)	Presidents' Day
(26)	Martin Luther King, Jr. Day
(27)	Memorial Day
(28)	Easter Sunday

(29) Juneteenth

New York State Department of Labor - Bureau of Public Work
State Office Building Campus
Building 12 - Room 130
Albany, New York 12226

REQUEST FOR WAGE AND SUPPLEMENT INFORMATION

As Required by Articles 8 and 9 of the NYS Labor Law

Fax (518) 485-1870 or mail this form for new schedules or for determination for additional occupations.

This Form Must Be Typed

Submitted By: (Check Only One) ☐ Contracting Agency ☐ Architect or Engineering Firm ☐ Public Work District Office Date:

A. Public Work Contract to be let by: (Enter Data Pertaining to Contracting/Public Agency)

1. Name and complete address ☐ (Check if new or change)

Telephone Fax

E-Mail:

2. NY State Units (see Item 5).

- ☐ 01 DOT
- ☐ 02 OGS
- ☐ 03 Dormitory Authority
- ☐ 04 State University Construction Fund
- ☐ 05 Mental Hygiene Facilities Corp.
- ☐ 06 OTHER N.Y. STATE UNIT
- ☐ 07 City
- ☐ 08 Local School District
- ☐ 09 Special Local District, i.e., Fire, Sewer, Water District
- ☐ 1O Village
- ☐ 11 Town
- ☐ 12 County
- ☐ 13 Other Non-N.Y. State (Describe)

3. SEND REPLY TO ☐ (check if new or change)
Name and complete address:

Telephone Fax

E-Mail:

4. SERVICE REQUIRED. Check appropriate box and provide project information.

☐ New Schedule of Wages and Supplements.

APPROXIMATE BID DATE :

☐ Additional Occupation and/or Redetermination

PRC NUMBER ISSUED PREVIOUSLY FOR THIS PROJECT :

OFFICE USE ONLY

B. PROJECT PARTICULARS

5. Project Title _____

Description of Work _____

Contract Identification Number _____

Note: For NYS units, the OSC Contract No. _____

6. Location of Project:
Location on Site _____

Route No/Street Address _____

Village or City _____

Town _____

County _____

7. Nature of Project - Check One:

- ☐ 1. New Building
- ☐ 2. Addition to Existing Structure
- ☐ 3. Heavy and Highway Construction (New and Repair)
- ☐ 4. New Sewer or Waterline
- ☐ 5. Other New Construction (Explain)
- ☐ 6. Other Reconstruction, Maintenance, Repair or Alteration
- ☐ 7. Demolition
- ☐ 8. Building Service Contract

8. OCCUPATION FOR PROJECT :

- ☐ Construction (Building, Heavy Highway/Sewer/Water)
- ☐ Tunnel
- ☐ Residential
- ☐ Landscape Maintenance
- ☐ Elevator maintenance
- ☐ Exterminators, Fumigators
- ☐ Fire Safety Director, NYC Only
- ☐ Fuel Delivery
- ☐ Guards, Watchmen
- ☐ Janitors, Porters, Cleaners, Elevator Operators
- ☐ Moving furniture and equipment
- ☐ Trash and refuse removal
- ☐ Window cleaners
- ☐ Other (Describe)

9. Does this project comply with the Wicks Law involving separate bidding? YES ☐ NO ☐

10. Name and Title of Requester

Signature

SEE PAGE TWO FOR LAWS RELATING TO PUBLIC WORK CONTRACTS

NEW YORK STATE DEPARTMENT OF LABOR
Bureau of Public Work - Debarment List

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Under Article 8 and Article 9 of the NYS Labor Law, a contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work or public building service contract/sub-contract with the state, any municipal corporation or public body for a period of five (5) years from the date of debarment when:

- Two (2) final determinations have been rendered within any consecutive six-year (6) period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements;
- One (1) final determination involves falsification of payroll records or the kickback of wages and/or supplements.

The agency issuing the determination and providing the information, is denoted under the heading 'Fiscal Officer'. DOL = New York State Department of Labor; NYC = New York City Comptroller's Office; AG = New York State Attorney General's Office; DA = County District Attorney's Office.

Debarment Database: To search for contractors, sub-contractors and/or their successors debarred from bidding or being awarded any public work contract or subcontract under NYS Labor Law Articles 8 and 9, or under NYS Workers' Compensation Law Section 141-b, access the database at this link: https://apps.labor.ny.gov/EDList/searchPage.do

For inquiries please call 518-457-5589.

NYSDOL Bureau of Public Work Debarment List 05/23/2025

Article 8

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	DOL	*****5754	0369 CONTRACTORS, LLC		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL	*****5784	A.J.M. TRUCKING, INC.		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	DOL		AKHLAQ OULAKH		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	NYC		ALL COUNTY SEWER & DRAIN, INC.		7 GREENFIELD DR WARWICK NY 10990	03/25/2022	03/25/2027
DOL	DOL	*****8387	AMERICAN PAVING & MASONRY, CORP.		8 FOREST AVE GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	DOL	*****8654	AMERICAN PAVING, INC.		8 FORREST AVE. GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	NYC		AMJED PARVEZ		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		ANGELO F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		ANGELO GARCIA		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL		ANGELO STANCO		8 FOREST AVE. GLEN COVE NY 11542	05/24/2024	05/24/2029
DOL	DOL		ANGELO TONDO		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	*****4231	ANKER'S ELECTRIC SERVICE, INC.		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	DOL		ANTHONY MONGELLI		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	NYC		ARADCO CONSTRUCTION CORP		115-46 132RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC		AVM CONSTRUCTION CORP		117-72 123RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC		AZIDABEGUM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****8421	B & B DRYWALL, INC		206 WARREN AVE APT 1WHITE PLAINS NY 10603	12/14/2021	12/14/2026
DOL	DOL		B&L RENOVATION CO.		618 OCEAN PARKWAY APT A6BROOKLYN NY 11230	09/17/2020	09/17/2025
DOL	NYC	*****2113	BHW CONTRACTING, INC.		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL	*****5078	BLACK RIVER TREE REMOVAL, LLC		29807 ANDREWS ROAD BLACK RIVER NY 13032	10/17/2023	10/17/2028
DOL	DOL		BRADLEY J SCHUKA		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****5161	CALADRI DEVELOPMENT CORP.		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	*****3391	CALI ENTERPRISES, INC.		1223 PARK STREET PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	*****4155	CASA BUILDERS, INC.	FRIEDLANDER CONSTRUCTION	64 N PUTT CONNERS ROAD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	AG	*****7247	CENTURY CONCRETE CORP		2375 RAYNOR ST RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****0026	CHANTICLEER CONSTRUCTION LLC		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	NYC	*****2117	CHARAN ELECTRICAL ENTERPRISES		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DOL		CHRISTOPHER GRECO		26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	*****2281	CORRAO TRUCKING, INC.		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL		CRAIG JOHANSEN		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	DOL	*****3228	CROSS-COUNTY LANDSCAPING AND TREE SERVICE, INC.	ROCKLAND TREE SERVICE	26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	*****7619	DANCO CONSTRUCTION UNLIMITED INC.		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL		DANIEL ROBERT MCNALLY		7 GREENFIELD DRIVE WARWICK NY 10990	03/25/2022	03/25/2027

NYSDOL Bureau of Public Work Debarment List 05/23/2025

Article 8

DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		DARWIN PEGUESE		6400 BALTIMORE NATIONAL SUITE 602CANTONSVILLE NY 21228	10/24/2024	10/24/2029
DOL	DOL		DAVID FRIEDLANDER		64 NORTH PUTT CORNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL		DINA TAYLOR		64 N PUTT CONNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	NYC		EAGLE GROUP LLC		2250 2ND AVE NEW YORK NY 10029	03/24/2025	03/24/2030
DOL	AG		EDWIN HUTZLER		23 NORTH HOWELLS RD BELLPORT NY 11713	08/04/2021	08/04/2026
DOL	DA		EDWIN HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****0780	EMES HEATING & PLUMBING CONTR		5 EMES LANE MONSEY NY 10952	01/20/2002	01/20/3002
DOL	DOL		EMIL KISZKO		84 DIAMOND ST BROOKLYN NY 11222	07/18/2024	07/18/2029
DOL	DOL	*****3298	EMJACK CONSTRUCTION CORP.		84 DIAMOND ST BROOKLYN NY 11222	07/18/2024	07/18/2029
DOL	DOL	*****3298	EMJACK CONSTRUCTION LLC		4192 SIR ANDREW CIRCLE DOYLESTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL		EUGENIUSZ "GINO" KUCHAR		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DA		FREDERICK HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****2998	G.E.M. AMERICAN CONSTRUCTION CORP.		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	NYC		GAYATRI MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DA		GIOVANNA TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DA		GIOVANNI NAPOLITANO		2501 BAYVIEW AVENUE WANTAGH NY 11793	02/21/2024	02/21/2029
DOL	DA	*****0213	GORILLA CONTRACTING GROUP, LLC		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DA	*****4760	GTX CONSTRUCTION ASSOCIATES, CORP		2501 BAYVIEW AVE WANTAGH NY 11793	02/21/2024	02/21/2029
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	*****2397	ISLAND BREEZE MARINE, INC.		6400 BALTIMORE NATIONAL CANTONSVILLE MD 21228	10/24/2024	10/24/2029
DOL	DOL	*****9211	J. WASE CONSTRUCTION CORP.		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		J.M.J CONSTRUCTION		151 OSTRANDER AVENUE SYRACUSE NY 13205	11/21/2022	11/21/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	12/12/2022	12/12/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027

DOL	DOL		JAMES J. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****7993	JBS DIRT, INC.		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL	*****2435	JEFFEL D. JOHNSON	JMJ7 AND SON	5553 CAIRNSTRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JEFFEL JOHNSON ELITE CARPENTER REMODEL AND CONSTRUCTION		C2 EVERGREEN CIRCLE LIVERPOOL NY 13090	11/21/2022	11/21/2027
DOL	DOL	*****2435	JEFFREY M. JOHNSON	JMJ7 AND SON	5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JIM PLAUGHER		17613 SANTE FE LINE ROAD WAYNEFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL		JMJ7 & SON CONSTRUCTION, LLC		5553 CAIRNS TRAIL LIVERPOOL NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 AND SONS CONTRACTORS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS		7014 13TH AVENUE BROOKLYN NY 11228	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS AND SONS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS, LLC		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JOHN MARKOVIC		47 MANDON TERRACE HAWTHORN NJ 07506	03/29/2021	03/29/2026
DOL	DOL		JOHN WASE		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		JORGE RAMOS		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	DOL		JOSEPH HALL		937 US ROUTE 11 CENTRAL SQUARE NY 13036	10/21/2024	10/21/2029
DOL	DOL	*****2271	JOSEPH HALL COMPANIES LLC		937 US ROUTE 11 CENTRAL SQUARE NY 13036	10/21/2024	10/21/2029
DOL	DOL		JOSEPH K. SALERNO		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL		JOSEPH K. SALERNO II		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		JRN CONSTRUCTION CO, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JULIUS AND GITA BEHREND		5 EMES LANE MONSEY NY 10952	11/20/2002	11/20/3002
DOL	DOL		KARIN MANGIN		796 PHELPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	DOL		KATE E. CONNOR		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026

DOL	DOL		KEAN INDUSTRIES, LLC		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL	*****2959	KELC DEVELOPMENT, INC		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KEVIN FUNEZ URBINA A/K/A KEVIN FUNEZ		1009 LYNDALE AVE TRENTON NJ 08629	12/16/2024	12/16/2029
DOL	DOL		KIMBERLY F. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL	*****8760	KJ&J CONSTRUCTION, LLC		1009 LYNDALE AVE TRENTON NJ 08629	12/16/2024	12/16/2029
DOL	DOL		KMA GROUP II, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL	*****1833	KMA GROUP INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KMA INSULATION, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KRIN HEINEMANN		2345 ROUTE 52, SUITE 2N HOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	NYC		KULWANT S. DEOL		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DA	*****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL	*****3716	LIGHTNIN ELECTRIC INC.		3418 NORTHERN BLVD SUITE 5-27LONG ISLAND CITY NY 11101	12/13/2024	12/13/2029
DOL	AG	*****3291	LINTECH ELECTRIC, INC.		3006 TILDEN AVE BROOKLYN NY 11226	02/16/2022	02/16/2027
DOL	DOL		LOUIS A. CALICCHIA		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	NYC		LU THOMAS NICAJ		429 WEAVER STREET LARCHMONT NY 10538	03/24/2025	03/24/2030
DOL	DOL	*****2196	MAINSTREAM SPECIALTIES, INC.		11 OLD TOWN RD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DA		MANUEL P TOBIO		150 KINGS STREET BROOKLYN NY 14444	08/19/1998	08/19/2998
DOL	DA		MANUEL TOBIO		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		MAQSOOD AHMAD		618 OCEAN PKWY BROOKLYN NY 11230	09/17/2020	09/17/2025
DOL	DOL	*****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	*****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	DOL		MOHAMMAD MIAN		8269 21ST ST BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	NYC		MUHAMMED A. HASHEM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	NYC		NASEER CHAUDHRY		2349 BRAGG STREET BROOKLYN NY 11229	04/22/2025	04/22/2030
DOL	DOL	*****7790	NATIONAL BUILDING & RESTORATION CORP		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****1797	NATIONAL CONSTRUCTION SERVICES, INC		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	NYC		NAVIT SINGH		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		NELCO CONTRACTING, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DA		NICHOLAS T. ANALITIS		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026

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DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****7429	NICOLAE I. BARBIR	BESTUCCO CONSTRUCTION, INC.	444 SCHANTZ ROAD ALLENTOWN PA 18104	09/17/2020	09/17/2025
DOL	DOL		NIKOLA NTONI		3418 NORTHERN BLVD SUITE 5-27LONG ISLAND CITY NY 11101	12/13/2024	12/13/2029
DOL	NYC	*****6971	NN CONSTRUCTION, INC.		2349 BRAGG STREET BROOKLYN NY 11229	04/22/2025	04/22/2030
DOL	NYC	*****5643	NYC LINE CONTRACTORS, INC.		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PAULINE CHAHALES		935 S LAKE BLVD MAHOPAC NY 10541	03/02/2021	03/02/2026
DOL	DOL		PETER STEVENS		11 OLD TOWN ROAD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DOL	*****4168	PHANTOM CONSTRUCTION CORP.		95-27 116TH STREET QUEENS NY 11419	07/12/2024	07/12/2029
DOL	DOL	*****4168	PHANTOM CONSTRUCTION CORP.		95-27 116TH STREET QUEENS NY 11419	05/28/2024	05/28/2029
DOL	DOL	*****4772	R.W. LOBDELL CONSTRUCTION LLC		635 WEST DRYDEN ROAD FREEVILLE NY 13068	01/31/2025	01/31/2030
DOL	NYC		RASHEL CONSTRUCTION CORP		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****2633	RAW POWER ELECTRIC CORP.		3 PARK CIRCLE MIDDLETOWN NY 10940	07/11/2022	07/11/2027
DOL	DA	*****7559	REGAL CONTRACTING INC.		24 WOODBINE AVE NORTHPORT NY 11768	10/01/2020	10/01/2025
DOL	DOL		ROBBYE BISSESAR		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	01/11/2003	01/11/3003
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	07/11/2022	07/11/2027
DOL	DOL	*****7172	RZ & AL INC.		198 RIDGE AVENUE VALLEY STREAM NY 11581	06/06/2022	06/06/2027
DOL	DOL		SAL FRESINA MASONRY CONTRACTORS, INC.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL		SAL MASONRY CONTRACTORS, INC.		(SEE COMMENTS) SYRACUSE NY 13202	07/16/2021	07/16/2026
DOL	DOL	*****9874	SALFREE ENTERPRISES INC		P.O BOX 14 2821 GARDNER RDPOMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		SALVATORE A FRESINA A/K/A SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DOL		SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DA	*****0476	SAMCO ELECTRIC CORP.		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DA		SILVANO TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DOL	*****0440	SOLAR GUYS INC.		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	NYC		SOMATIE RAMSUNAHAI		115-46 132ND ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC	*****3661	SPANIER BUILDING MAINTENANCE CORP		200 OAK DRIVE SYOSSET NY 11791	03/14/2022	03/14/2027
DOL	DOL		STANADOS KALOGELAS		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL	*****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	*****9528	STEEL-IT, LLC.		17613 SANTE FE LINE ROAD WAYNESFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL	*****3800	SUBURBAN RESTORATION CO. INC.		5-10 BANTA PLACE FAIR LAWN PLACE NJ 07410	03/29/2021	03/29/2026
DOL	DOL	*****9150	SURGE INC.		8269 21ST STREET BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	DOL		SYED MUHAMMAD S. JAFRI A/K/A SHARRUKH JAFRI		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029

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DOL	DOL		TARLOK SINGH		95-27 116TH STREET QUEENS NY 11419	05/28/2024	05/28/2029
DOL	DOL		TARLOK SINGH		95-27 116TH STREET QUEENS NY 11419	07/12/2024	07/12/2029
DOL	DOL	*****9733	TERSAL CONSTRUCTION SERVICES INC		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13208	07/16/2021	07/16/2026
DOL	DOL		TERSAL CONTRACTORS, INC.		221 GARDNER RD P.O BOX 14POMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		TERSAL DEVELOPMENT CORP.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****2426	THE MATRUKH GROUP, INC.		4307 28TH AVE PO BOX 9082ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	DOL		THOMAS LOBDELL		635 WEST DRYDEN ROAD FREEVILLE NY 13068	01/31/2025	01/31/2030
DOL	DOL		TIMOTHY PERCY		29807 ANDREWS ROAD BLACK RIVER NY 13612	10/17/2023	10/17/2028
DOL	DA	*****1050	TRI STATE CONSTRUCTION OF NY CORP.		50-39 175TH PLACE FRESH MEADOWS NY 11365	03/28/2022	03/28/2027
DOL	DA	*****4106	TRIPLE H CONCRETE CORP		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****8210	UPSTATE CONCRETE & MASONRY CONTRACTING CO INC		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	*****6418	VALHALLA CONSTRUCTION, LLC.		796 PHLEPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	NYC	*****2426	VICKRAM MANGRU	VICK CONSTRUCTI ON	21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	NYC		VICKRAM MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DOL		VINCENT CORRAO		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL	*****8266	WILLIAM CHRIS MCCLENDON	MCCLENDON ASPHALT PAVING	1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM CHRIS MCCLENDON		1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM G. PROERFRIEDT		85 SPRUCEWOOD ROAD WEST BABYLON NY 11704	01/19/2021	01/19/2026
DOL	DOL	*****5924	WILLIAM G. PROPHY, LLC	WGP CONTRACTIN G, INC.	54 PENTAQUIT AVE BAYSHORE NY 11706	01/19/2021	01/19/2026
DOL	DOL		WILLIAM SCRIVENS		4192 SIR ANDREW CIRCLE DOYELSTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL		XENOFON EFTHIMIADIS		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028

GENERAL REQUIREMENTS

FOR

RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE – PHASE 2

CORNELL UNIVERSITY
ITHACA, NEW YORK

MAY 9, 2025

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SECTION 01 11 00 SUMMARY OF WORK

1.0 GENERAL

1.1 DESCRIPTION

A. Work to be Done

1. Renovate approximately 15,400 sf of the Livestock Pavilion into surge space for future laboratory and office use. Work includes construction of a second-floor addition within the existing building volume, including associated concrete foundations and structural steel. It also involves improvements to the exterior building envelope to include replacement of the lower slate roof, removal and/or replacement of exterior doors and storefront systems, upgrades to exterior walls for energy performance and repairs to historic wood windows and wood trim. The scope includes construction of interior partitions, flooring, ceilings, casework, laboratory equipment, mechanical, electrical, plumbing, fire protection and audio-visual systems. Exterior work will also include construction of concrete sidewalks, plantings, and modifications of/upgrades to storm drainage systems..

B. The Scope of the Work

1. The scope of the Work in all SECTIONS of this Specification shall consist of the furnishing of all labor, materials, equipment and appliances and the performance of the Work required by the Contract Documents and/or by the conditions at the site, joining all parts of this Work with itself and the Work of others to form a complete, functioning entity.

2. Items not specifically mentioned in the Specifications or shown on the drawings, but which are inherently necessary to make a complete working installation, shall be included.

3. It is the intent and purpose of the Contract Documents to cover and include under each item all materials, machinery, apparatus, and labor necessary to properly install materials and equipment, adjust and put into perfect operation the respective portions of the installation specified and to so interconnect the various items or sections of the Work as to form a complete and operating whole. Any equipment, apparatus, machinery, material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of the installation in a substantial manner, and in compliance with the requirements stated, implied, or intended in the Contract Documents, shall be furnished without extra cost to the Owner. The Contractor shall provide the greatest quantity, highest quality, highest degree of safety, and most stringent material, equipment or work. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract.

1.2 WORK UNDER OTHER CONTRACTS

A. The Contractor shall cooperate with other contracts performing related work, including providing labor, materials and other costs necessary to satisfactorily coordinate the Contract Work with work performed under others contracts.

B. Preceding Work:

1. In Phase 1 of the project the Contractor:

a. Demolished existing concrete seating within the facility.

b. Abated selection ACM within the facility

c. Demolished existing MEP services/systems

d. Extended existing MEP services to the facility

e. Cornell University Grounds/Line crew removed the existing 2.4Kva transformer and replaced it with a 13.2 transformer

C. New York State Electric & Gas (NYSEG):

1. Contractor shall be responsible for the project management of NYSEG work including coordinating any scheduling associated with the Project.

2. The Owner shall be responsible for the cost associated with the work to be performed by NYSEG. No NYSEG costs shall be carried in the Contractor's bid.

1.3 SCHEDULE OF OWNER FURNISHED ITEMS

A. Site utility, building, and SWPPP permits provided by Architectural Resources. The building furniture package will be provided by Cornell University for installation by the contractor.

B. The Contractor shall receive, unload, store and install Owner furnished equipment as shown on the plans and called for in the Specifications.

C. Storage

1. Upon written acknowledgment by Contractor of receipt in proper condition, the Contractor shall maintain responsibility for proper storage and protection of the equipment. Provide insurance for the Owner-furnished products up to the time of Final Acceptance by the Owner.

D. Receiving and Unloading

1. The Contractor shall be responsible for logging in, checking and verifying receipt of items and shall be responsible for confirming that the quantities and condition of the materials are appropriate for installation and the completion of the Work of the project.

2. The Contractor shall note any damage and/or short count on the Bill of Loading for any Owner Furnished Equipment received at the storage facility, such listing of damages or short count being required to establish the Owner's potential claim against the carrier. The Contractor shall also notify the Owner directly on any such damage and/or short count.

3. Unload Owner Furnished Equipment at the job site using necessary care and equipment as required to handle the equipment in a safe manner.

4. Use adequate numbers of skilled workers necessary to handle, receive and install Owner Furnished Equipment.

5. Install Owner Furnished Equipment as called for in the Drawings or in these Specifications.

E. Installation

1. Install products in conformance with manufacturer’s installation instructions.

2. Provide interconnecting structures, equipment, piping, electrical and instrumentation work, finish painting, and appurtenances to achieve a complete and functional system.

F. Use of Materials

1. The Contractor shall be responsible for the use of Owner provide materials in an efficient manner in accordance with industry standards and best practices to reduce waste materials.

1.4 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A geotechnical investigation report for Project, prepared by Whitestone Associates Engineering & Geology NY, PLLC, dated August 9, 2024, is available for viewing as appended to this Document.

C. Soil-boring data for Project, obtained by Whitestone Associates Engineering & Geology NY, PLLC, dated August 9, 2024, is available for viewing as appended to this Document.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 11 00*****

500 CANAL VIEW BOULEVARD
SUITE 700
ROCHESTER, NY 14623
585.252.6879
whitestoneassoc.com

August 9, 2024

via email

ARCHITECTURAL RESOURCES
505 Franklin Street
Buffalo, New York 14202

Attention: James R. Maurer, AIA
Project Manager

Regarding: LIMITED GEOTECHNICAL INVESTIGATION
PROPOSED LIVESTOCK PAVILION CONVERSION
CORNELL UNIVERSITY
48 JUDD FALLS ROAD
ITHACA, TOMPKINS COUNTY, NEW YORK
WHITESTONE PROJECT NO.: GR2422234.Y00

Dear Mr. Maurer:

Whitestone Associates Engineering & Geology NY, PLLC (Whitestone) has completed a limited geotechnical investigation at the above-referenced site. The results of the investigation and recommendations presented below are based on the soil conditions disclosed from a limited number of borings conducted during Whitestone's field investigation. The purpose of the investigation was to assess subsurface conditions within the existing building accessible to rubber track-mounted drilling equipment. Recommendations for support of proposed additional columns, walls, and slab for the building conversion, and anticipated earthwork requirements are included herein.

1.0 PROJECT DESCRIPTION

1.1 Site Location & Existing Conditions

The Livestock Pavilion is located on Cornell University campus at 48 Judd Falls Road in Ithaca, Tompkins County, New York. The approximately 15,000-square feet building is a two-story structure.

1.2 Site Geology

According to the University of the State of New York, The State Education Department *Surficial Geologic Map of New York, Finger Lakes Sheet* (1987), the site is underlain by lacustrine silt and clay. The University of the State of New York, The State Education Department *Geologic Map of New York, Finger Lakes Sheet* (1970) indicates that the bedrock underlying the site, at depth, is the Upper Devonian-age Genesee Group, consisting of limestone and shale with minor siltstone and incidental black shale. The site is not mapped as being in a karst area.

1.3 Proposed Construction

Based on an undated site plan and details provided by Architectural Resources, the proposed conversion to a flexible wet lab and office building will include new foundations to accommodate increased structural loads and a new floor slab.

Detailed structural information was not available at the time of this report. Maximum design loads are assumed to be less than the following: column loads - 100 kips, wall loads - 6.0 kips/lineal foot, and floor loads - 125 pounds per square feet.

2.0 FIELD EXPLORATION & TESTING

2.1 Field Exploration

Field exploration at the project site consisted of advancing two borings (identified as B-101 and B-102). The borings subsequently were backfilled to the surface with excavated soils from the investigation. The locations of the borings are shown on the accompanying *Boring Location Plan* included as Figure 1. *Records of Subsurface Exploration* are provided in Appendix A.

The subsurface tests were conducted in the presence of a Whitestone engineer, who conducted field tests, recorded visual classifications, and collected samples of the various strata encountered. Test locations were established in the field using normal taping procedures and estimated right angles. These locations are presumed to be approximate.

The borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D1586. The SPT resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations, where encountered, were recorded during and immediately after the completion of field operations prior to backfilling the tests. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater levels.

2.2 Laboratory Testing

Representative samples of the site soils were subjected to laboratory testing that included moisture content determinations (ASTM D2216), in order to conduct supplementary engineering soil classifications in general accordance with ASTM D2487. The soil strata tested were classified by the Unified Soil Classification System (USCS). Moisture contents are shown on the *Records of Subsurface Exploration*.

3.0 SUBSURFACE CONDITIONS

The subsurface soil conditions encountered within the subsurface tests conducted by Whitestone consisted of the following generalized strata in order of increasing depth. *Records of Subsurface Exploration* are provided in Appendix A.

Surface Cover Materials: The borings encountered six inches of sawdust at the ground surface.

Existing Fill: Beneath the surface cover materials, boring B-101 encountered existing fill, consisting of reddish-brown to black, medium dense, sandy silt. The SPT N-value within the existing fill was 27 blows per foot (bpf). The existing fill extended to a depth of two fbgs.

Lacustrine Deposit: Beneath the existing fill or surface cover materials, the borings encountered a lacustrine deposit, consisting of reddish-brown to brown, stiff to very stiff (occasionally hard), silty clay (USCS: CL). SPT N-values within the lacustrine deposit were variable, ranging from 12 bpf to 55 bpf. The lacustrine deposit extended to depths of 10 fbgs and 15 fbgs.

Glacial Till: Beneath the lacustrine deposit, the borings encountered glacial till, consisting of brown to dark brown to gray, dense to very dense (occasionally medium dense), sandy silt with gravel (USCS: ML), cobbles, boulders. SPT N-values within the glacial till were variable, ranging from 24 bpf to 100 bpf. The borings terminated in the glacial till at depths of 26.2 fbgs and 25.4 fbgs.

Groundwater: Groundwater was encountered in one boring (B-102) during the investigation at a depth of 15 fbgs. However, given the relatively impermeable nature of the site soils, the groundwater level may not have had time to stabilize during the exploration. Groundwater levels should be expected to fluctuate seasonally and following periods of precipitation.

4.0 CONCLUSIONS & RECOMMENDATIONS

Contingent upon construction phase evaluation, Whitestone's findings indicate that the new columns and walls associated with the conversion may be supported on conventional shallow foundations bearing on the properly inspected and approved lacustrine deposit, or structural fill placed over the lacustrine deposit. Existing fill was encountered in one boring to depth of two fbgs, however, deeper fill may be encountered during construction between the widely spaced borings. Any existing fill should be removed below footings and replaced with structural fill. The subgrade should be reviewed by the geotechnical engineer, as specified in this report prior to fill placement or structural support. The new floor slab may derive support from the inspected, improved, and approved existing fill or lacustrine deposit, and/or controlled structural fill materials.

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered within the limited exploration conducted. If there are any significant changes to the project characteristics or if significantly different subsurface conditions are encountered during construction, Whitestone should be consulted, to confirm the recommendations of this report remain valid.

4.1 Site Preparation & Earthwork

Surface Cover Stripping: Prior to stripping operations, any utilities should be identified and secured. Organic material should be removed from within the proposed new floor slab area. The contractor should be required to conduct earthwork in accordance with the recommendations in this report, including backfilling any excavation, etc. with structural fill.

Surface Preparation/Proofrolling: Prior to placing any fill to raise or restore grades to the desired subgrade elevations, if required, the existing exposed soils should be compacted to a firm and unyielding surface with several passes in two perpendicular directions of a minimum five-ton vibratory compactor. Fill and backfill should be placed and compacted in accordance with Section 4.2.

Subgrade Protection and Inspection: Every effort should be made to reduce disturbance of the on-site soils by construction traffic. The on-site materials may deteriorate when subjected to repeated construction traffic, which would require removal and replacement. Whitestone should be retained to observe soil conditions during construction and review the suitability of prepared foundation subgrades for support of design loads.

Groundwater Control: Groundwater was encountered in one boring at a depth of 15 fbgs. Shallower groundwater may be encountered during construction, perched above impermeable layers. As such, construction phase dewatering may consist of removing infiltrating water or trapped water at this site. Whitestone anticipates that construction phase dewatering, if required, would include installing temporary sump pits and filtered pumps within trenches and excavations.

4.2 Structural Fill & Backfill

Imported Fill Material: Imported material placed as structural fill or backfill to restore design grades should consist of clean, relatively well-graded sand or gravel with a maximum particle size of three inches and up to 15 percent of material finer than a #200 sieve. The material should be free of clay lumps, organics, and deleterious material. Any imported structural fill material should be approved by a qualified geotechnical engineer prior to delivery to the site.

Soil Reuse: The fine-grained lacustrine deposit is marginally acceptable for reuse as structural fill and/or backfill because of difficult workability. Reuse of the fine-grained soil will likely require moisture conditioning and/or drying to facilitate reuse, workability, and compaction in fill areas. Stringent quality control and inspection by the geotechnical engineer will be required for suitable portions of the on-site soils to be reused as structural fill and backfill, and to confirm that the soils are properly placed and compacted within two percent of their optimum moisture content. Alternatively, imported fill materials could be sued to expedite earthwork operations.

Submerged Fill: In the wet (flooding, perched water, or groundwater), consideration should be given to placing an open-graded, minus one-inch crushed stone to provide a working mat, expedite dewatering efforts and enable subsequent placement of structural fill or backfill in the dry. Prior to placing submerged fill materials, free water and disturbed materials should be removed to the extent recommended by the geotechnical engineer. A fines barrier geotextile, such as *Mirafi 140N* or equivalent, should be placed at the base and sides of the overexcavation to separate the crushed stone from underlying and adjacent soils. The fabric also should be placed on top of the crushed stone prior to subsequent fill placement, if fill soils with a substantial amount of fines are to be used to restore grade.

Compaction and Placement Requirements: Fill and backfill should be placed in loose lifts no more than 12 inches thick when compacted with a vibratory roller compactor weighing at least one ton, and eight inches when compacted with a plate compactor. Fill and backfill should be compacted to 95 percent of the maximum dry density within three percent of the optimum moisture content, as determined by ASTM D1557 (Modified Proctor).

4.3 Foundation Design Criteria

Foundations: The results of the investigation and engineering analyses indicated that the proposed new columns and walls may be supported on conventional shallow foundations bearing on the properly inspected and approved lacustrine deposit, or structural fill placed over the lacustrine deposit. Existing fill was encountered in one boring to a depth of two fbgs, however, deeper fill may be encountered during

construction between the widely spaced borings. Any existing fill should be removed below footings and replaced with structural fill. Foundations bearing on suitably prepared subgrades may be designed to impart a maximum allowable net bearing pressure of 4,000 pounds per square feet. Regardless of loading conditions, new foundations should be sized no less than minimum dimensions of 24-inches for continuous wall footings and 36-inches for isolated column footings.

Foundation subgrades within the fine-grained, lacustrine deposit should be compacted with a roller operated in static mode in the presence of the geotechnical engineer to densify any disturbed soils. The fine-grained soils are susceptible to disturbance by vibrations from compaction equipment and other construction activity. Compaction should therefore only be attempted under the direction of the geotechnical engineer, such that the underlying fine-grained materials do not become disturbed by the compaction process. A smooth bladed bucket would be appropriate for excavation of the fine-grained soils. Should the lacustrine deposit soften, consideration should be given to the option of placing geotextile separation fabric and a few inches of crushed stone over the soil exposed in the bottom of foundation excavations after removal of the softened soil to reduce the likelihood of disturbance and provide a working surface for formwork and reinforcing steel placement.

Footings subject to lateral loads and/or overturning should be designed such that the maximum toe pressure due to the combined effect of vertical loads and overturning moment does not exceed the recommended maximum allowable net bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the footings such that no uplift or tension exists between the base of the footings and the supporting soil. Uplift loads should be resisted by the weight of the concrete. Side friction should be neglected when proportioning the footings such that lateral resistance should be provided by friction resistance at the base of the footings. An allowable coefficient of friction against sliding of 0.3 is recommended for use in the design of the foundations bearing within the existing site soils or imported structural fill soils.

Seismic Site Class: Based on a review of the subsurface conditions relevant to the *New York State Building Code*, the subject site has been assigned a Site Class D. The site soils are not susceptible to earthquake induced liquefaction.

Inspection/Overexcavation Criteria: Whitestone recommends that the suitability of the bearing soils at the footing bottoms be reviewed by a geotechnical engineer immediately prior to placing concrete for the footings. In the event that areas of unsuitable materials are encountered, additional overexcavation and replacement of the materials may be necessary to provide a suitable footing subgrade. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation may be eliminated if grades are restored with lean concrete.

Frost Coverage: Interior footings not subject to frost action may be placed at a depth of 18 inches below the slab subgrade but should not be placed on the existing fill. Any foundations subject to frost action (including during construction) should be placed at least 48 inches below adjacent exterior grades, or the depth required by local building codes, to provide protection from frost penetration.

Settlement: Whitestone estimates post construction settlements of proposed foundations of less than one inch, if the recommendations outlined in this report are properly implemented. Differential settlement of foundations should be less than one half inch.

4.4 Floor Slab

After removal of the sawdust, Whitestone anticipates that the properly inspected, approved, and improved existing fill or lacustrine deposit, and/or compacted structural fill will be suitable for support of the proposed floor slab, provided these materials are properly evaluated, compacted, and proofrolled in accordance with the recommendations of this report during favorable weather conditions. Areas that are, or become, softened or disturbed as a result of wetting and/or repeated exposure to construction traffic or contain objectionable materials should be removed and replaced with compacted structural fill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 150 psi/in.

A minimum 12-inch layer of NYSDOT *733-04 Subbase Course, Type 2* (or approved equivalent) should be placed below the floor slab to provide a uniform granular base. If the floor supports moisture-sensitive covering or equipment, a moisture vapor barrier should also be installed beneath the floor slab in accordance with flooring manufacturer's recommendations.

4.6 Retaining Walls/Lateral Earth Pressures

The following parameters may be used for design of any below-grade walls and other structures reliant on granular materials to provide adequate drainage.

Below-grade walls should be capable of withstanding active and at-rest earth pressures. Backfill soils adjacent to these structures should consist of freely draining granular fill composed primarily of coarse to fine sand. With an active earth pressure coefficient (K_a) of 0.33, level backfill, and an assumed maximum backfill soil unit weight of 140 pounds per cubic foot (pcf), an equivalent fluid pressure of 46 psf per foot of wall height should be used in design of below-grade walls which are free to rotate.

Below-grade walls and wall corners typically are restrained from lateral movement and should be designed using at-rest earth pressures. A coefficient of at-rest earth pressure (K_o) of 0.5, for a level backfill, is recommended for retaining/below-grade walls designed to resist at-rest earth pressures, which assume no lateral movement. With an assumed maximum total unit weight of backfill of approximately 140 pcf, an equivalent fluid pressure of 70 pounds per square foot per foot of wall height should be used in design of restrained below-grade wall and wall corners. A coefficient of friction of 0.3 against sliding can be used for concrete on the existing site soils. Additional lateral earth pressures from a sloped backfill or any temporary or long-term surcharge loads also should be included in the design.

Whitestone recommends that granular soils be used to backfill behind below-grade walls. The granular backfill materials should consist of clean, relatively well-graded sand or gravel with a maximum particle size of three inches and up to 15 percent, by weight, of material finer than a #200 U.S. Standard sieve. Whitestone recommends that backfill directly behind any walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone of influence measured at a 45-degree angle from the base of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

Positive drainage should be provided at the base of the below-grade walls. Where wall drainage is not provided or cannot be relied upon, walls are designed to withstand full hydrostatic pressure.

Whitestone should be notified if any other retaining structures or design considerations requiring lateral earth pressure estimations are proposed. Specific recommendations for temporary retaining structures are beyond Whitestone's scope of work.

4.7 Excavations

The site soils encountered during the investigation generally are most consistent with, at least, Type B Soil Conditions as defined by 29 CFR Part 1926 (OSHA) that require a maximum unbraced excavation angle of 1:1 (horizontal:vertical). Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA), so that safe excavation methods and/or shoring and bracing requirements are implemented.

Care should be taken when excavating close to existing foundations. Excavation should not undermine or otherwise disturb existing footings. As a guide, excavation should not be conducted within a slope of 1:1 (horizontal to vertical) out and down from the outside edge of the existing footings. Should excavation be required within this zone, the existing foundation should be underpinned. In addition, depending on the configuration of the existing footings and foundation walls with respect to the proposed excavations, lateral support may also have to be provided until the new structure is in place and the area is backfilled.

5.0 SUPPLEMENTAL POST INVESTIGATION SERVICES

Construction Inspection and Monitoring: The owner's geotechnical engineer with specific knowledge of the site subsurface conditions and design intent should conduct inspection, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing should also be conducted to confirm that any encountered underground structures are properly backfilled, the existing surface cover materials are properly removed, and suitable materials, used for controlled fill, are properly placed and compacted over suitable subgrade soils. The proofrolling of all subgrades prior to floor slab support should be witnessed and documented by the owner's geotechnical engineer.

6.0 CLOSING

Whitestone's Geotechnical Division appreciates the opportunity to be of service to Architectural Resources. Whitestone has the capability to conduct the additional geotechnical engineering services recommended herein. Please contact us at (585) 252-6879 with any questions regarding this report.

Sincerely,

WHITESTONE

Charles B. Guzzetta, P.G.
Regional Manager, Upstate New York

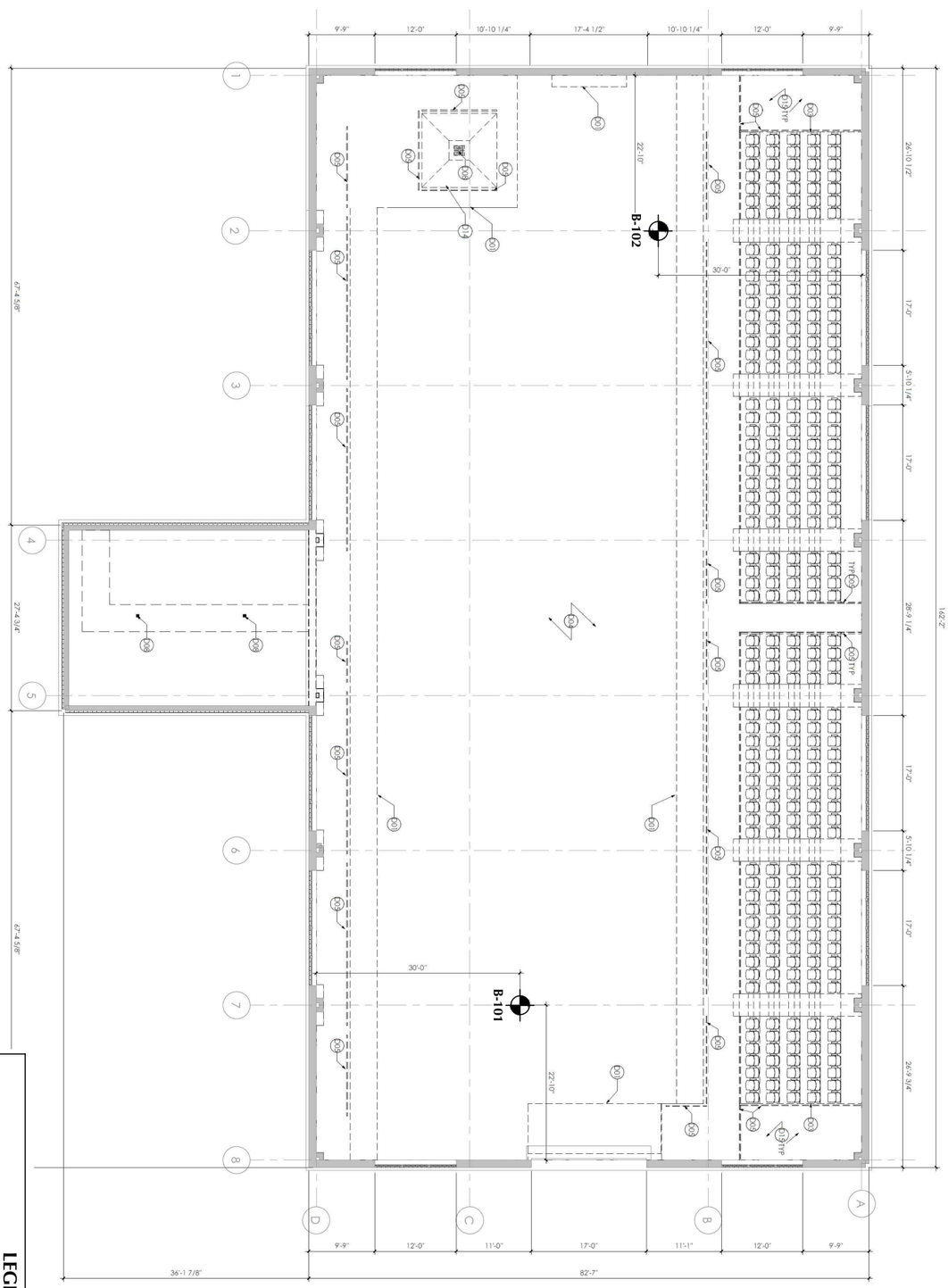
Ryan R. Roy, P.E.
Vice President

RWM/th P:\Job Folders\2024\2422234GR\Reports and Submittals\Cornell Livestock Pavilion Conversion Ithaca NY GR2422234.Y00 LimGI 8-9-24.doc
Enclosures

WHITESTONE

FIGURE 1
Boring Location Plan

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0
1 inch = 20 ft.
20

LEGEND

BORING LOCATION

NOTE: ALL LOCATIONS ARE APPROXIMATE.

REFERENCE

THIS PLAN IS BASED ON AN UNDATED SITE PLAN PREPARED BY ARCHITECTURAL RESOURCES.

PROJECT #:	GR2422234.Y00
DESIGNED BY:	MR
DATE:	8/8/24
SCALE:	1" = 20'
PROJ. MGR.:	CG
FIGURE:	1

DRAWING TITLE:
BORING LOCATION PLAN

CLIENT:
ARCHITECTURAL RESOURCES

PROJECT:
PROPOSED LIVESTOCK PAVILION CONVERSION
CORNELL UNIVERSITY
48 JUDD FALLS ROAD
ITHACA, TOMPKINS COUNTY, NEW YORK

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WHITESTONE

APPENDIX A
Records of Subsurface Exploration

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-101

Project:	Proposed Livestock Pavilion Conversion - Cornell University	**WAI Project No.:**	GR2422234.Y00
Location:	48 Judd Falls Road, Ithaca, Tompkins County, New York	**Client:**	Architectural Resources

Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	7/10/2024		**Water Depth | Elevation** (feet bgs) | (ft NAVD88)		**Cave-In Depth | Elevation** (feet bgs) | (ft NAVD88)
Termination Depth:	26.2 feet bgs	**Date Completed:**	7/10/2024				
Proposed Location:	Building	**Logged By:**	FM	**During:**	-- | --		
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	EE	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	CME 550X	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							SAWDUST		6" Sawdust	
0 - 2	S-1	X	2 - 4 - 8 - 15	13	27		EXISTING FILL		Reddish-Brown to Black, Medium Dense, Sandy Silt (FILL)	
						2.0				
2 - 4	S-2	X	16 - 15 - 40 - 40	18	55				Reddish-Brown, Hard, Silty Clay (CL)	
4 - 6	S-3	X	5 - 6 - 7 - 7	16	13	5.0			As Above, Brown, Stiff (CL)	
							LACUSTRINE DEPOSIT			
6 - 8	S-4	X	8 - 8 - 9 - 16	20	17				As Above, Very Stiff (CL)	
8 - 10	S-5	X	9 - 10 - 15 - 16	13	25				As Above (CL)	
						10.0				
10 - 12	S-6	X	12 - 30 - 30 - 31	15	60				Brown, Very Dense, Sandy Silt with Gravel (ML)	
						15.0				
15 - 16.3	S-7	X	22 - 22 - 50/3"	10	44				As Above, Dense (ML)	Cobbles & Boulders
							GLACIAL TILL			
						20.0				
20 - 22	S-8	X	10 - 35 - 37 - 31	20	72				As Above, Very Dense (ML)	
						25.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-101

Project:	Proposed Livestock Pavilion Conversion - Cornell University	**WAI Project No.:**	GR2422234.Y00
Location:	48 Judd Falls Road, Ithaca, Tompkins County, New York	**Client:**	Architectural Resources

Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	7/10/2024	**Water Depth | Elevation** (feet bgs) | (ft NAVD88)		**Cave-In Depth | Elevation** (feet bgs) | (ft NAVD88)	
Termination Depth:	26.2 feet bgs	**Date Completed:**	7/10/2024				
Proposed Location:	Building	**Logged By:**	FM	**During:**	-- | --		
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	EE	**At Completion:**	-- | --	**At Completion:**	-- | --
		Equipment:	CME 550X	**24 Hours:**	-- | --	**24 Hours:**	-- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						25.0				
25 - 26.2	S-9	X	30 - 50 - 50/2"	8	100		GLACIAL TILL		Brown, Very Dense, Sandy Silt with Gravel (ML)	
									Boring Log B-101 Terminated at Depth of 26.2 feet below ground surface	
						30.0				
						35.0				
						40.0				
						45.0				
						50.0				

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-102

Project:	Proposed Livestock Pavilion Conversion - Cornell University	**WAI Project No.:**	GR2422234.Y00
Location:	48 Judd Falls Road, Ithaca, Tompkins County, New York	**Client:**	Architectural Resources

				Water Depth | Elevation (feet bgs) | (ft NAVD88)	Cave-In Depth | Elevation (feet bgs) | (ft NAVD88)
Surface Elevation:	± NS feet Above NAVD88	**Date Started:**	7/10/2024		
Termination Depth:	25.4 feet bgs	**Date Completed:**	7/10/2024		
Proposed Location:	Building	**Logged By:**	FM	**During:** 15.0 | --	
Drill / Test Method:	HSA / SPT (Autohammer)	**Contractor:**	EE	**At Completion:** -- | --	**At Completion:** -- | --
		Equipment:	CME 550X	**24 Hours:** -- | --	**24 Hours:** -- | --

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							SAWDUST		6" Sawdust	
0 - 2	S-1	X	8 - 7 - 9 - 9	16	16				Reddish-Brown, Very Stiff, Silty Clay (CL)	w/c = 19.1%
2 - 4	S-2	X	10 - 10 - 12 - 14	14	22				As Above (CL)	w/c = 17.8%
4 - 6	S-3	X	4 - 5 - 7 - 9	12	12	5.0			As Above, Brown, Stiff (CL)	w/c = 23.2%
6 - 8	S-4	X	9 - 9 - 9 - 9	20	18		LACUSTRINE DEPOSIT		As Above, Very Stiff (CL)	w/c = 28.1%
8 - 10	S-5	X	4 - 6 - 6 - 8	22	12				As Above, Stiff (CL)	w/c = 29.8%
10 - 12	S-6	X	6 - 6 - 8 - 12	24	14	10.0			As Above (CL)	w/c = 25.2%
						15.0				
15 - 17	S-7	X	9 - 12 - 12 - 45	15	24				Dark Brown, Medium Dense, Sandy Silt with Gravel (ML)	w/c = 13.6%
						20.0	GLACIAL TILL			
20 - 22	S-8	X	21 - 27 - 35 - 40	18	62				As Above, Very Dense (ML)	w/c = 18.1%
24 - 25.4	S-9	X	22 - 22 - 50/3"	10	88	25.0			As Above, Gray (ML) Boring Log B-102 Terminated at Depth of 25.4 feet below ground surface	w/c = 17.5%

NOTES: bgs = below ground surface, msl = mean sea level, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

APPENDIX B
Supplemental Information (USCS, Terms & Symbols)

WHITESTONE

500 CANAL VIEW BOULEVARD
SUITE 700
ROCHESTER, NY 14623
585.252.6879
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT

TRACE..... 1% TO 10%
LITTLE..... 10% TO 20%
SOME..... 20% TO 35%
AND..... 35% TO 50%

COMPACTNESS*
Sand and/or Gravel

RELATIVE DENSITY

LOOSE. ..... 0% TO 40%
MEDIUM DENSE.... 40% TO 70%
DENSE..... 70% TO 90%
VERY DENSE..... 90% TO 100%

CONSISTENCY*
Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT..... LESS THAN 250
SOFT..... ..... 250 TO 500
MEDIUM..... 500 TO 1000
STIFF..... 1000 TO 2000
VERY STIFF..... 2000 TO 4000
HARD..... GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

L:\Geotechnical Forms and References\Reports\USCSTRMSSYM - Rochester.docx

WHITESTONE

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585.252.6879
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GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

SECTION 01 14 00 WORK RESTRICTIONS

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 CONTRACTOR USE OF PREMISES

A. All traffic and pedestrian control measures shall be compliant with the **National Manual on Uniform Traffic Control Devices for Streets and Highways** (MUTCD) and **17 NYCRR Chapter V** (New York Supplement), (https://www.dot.ny.gov/mutcd) and all other local laws and regulations.

B. The Contractor shall carry on the Work in the manner which will cause the least interruption to pedestrian and vehicular traffic and permit access of emergency vehicles at all times.

C. The Work shall be scheduled and performed in such a manner that at least one lane of traffic will be maintained on all public streets. Two flag persons, equipped with adequate means of communication, must be provided for any activity blocking a traffic lane. One lane of traffic must be maintained at all times. Where traffic must cross open trenches, the Contractor shall provide suitable bridges and railings; including pedestrian bridges.

D. The Contractor shall maintain 20' minimum fire lane access to all facilities in the area, unless pre-approved by the University Fire Marshall office and local fire official.

E. The Contractor shall post and maintain flag persons and suitable signs indicating that construction operations are under way and other warning signs as may be required.

F. The Contractor shall safeguard the use by the public and Owner of all adjacent highways, roadways and footpaths, outside the Contract Limit Lines (work area), and shall conform to all laws and regulations concerning the use thereof, especially limitations on traffic and the movement of heavy equipment. Access to the site for delivery of construction materials and/or equipment shall be made only at the locations shown in the Contract Documents or approved by the Owner's Representative.

G. The Contractor shall make every effort to keep dirt and debris from making its way to roadways. The Contractor shall immediately remove dirt and debris which may collect on permanent roadways due to the Work.

H. The Contractor shall limit the extent of its activities to that area of the site defined on the Contract Drawings as being within the Contract Limit Lines.

I. For that portion of the Work required under this Contract which must be performed in other than the defined areas both on-site and off, including operations involving delivery and removal of materials, the Contractor shall schedule and coordinate its activities through the Owner's Representative, to meet the approval of the Owner and minimize disruption of the normal scheduled activities of the occupants of adjacent spaces.

J. It is the Owner's expectation that the Contractor will take protective measures to minimize damage caused by construction activities including, but not limited to, the use of personnel lifts, material handling equipment, on-site material storage, etc. All portions of the site, including the staging area and those areas affected by the Work, shall be returned to their original condition after completion of Work. Such repair work shall include lawn restoration and reseeding, if required, and shall be included in the Contractor's Guarantee of Work.

K. Routes to and from the location of the Work shall be as indicated in the Contract or as directed by the Owner's Representative. Temporary roadways shall be closed only with prior approval of the Owner's Representative.

L. Parking may be made available for staging at Bookbank Drive or other pre-determined area for the duration of the project. The Contractor will be responsible for fencing, securing and maintaining the designated area. All vehicles at Bookbank Drive, or other predetermined areas, must be registered with Transportation Services.

1.3 UNIVERSITY CLOSURES

A. In the event of University closure, the Contractor should use their judgement, follow their internal guidance on continuity of operations, and the direction of law enforcement, as to whether or not they will maintain operations on construction sites on campus. They should make this decision with the awareness that Cornell response to any project needs (shutdowns, emergencies) will not possible and the maintenance of roads and walks will not be to normal operating standards.

B. With your safety as a top priority, the Cornell University Police allows you the ability to take advantage of our Emergency Mass Notification System that enables your cellphone to become a personal safety device for you. Contractor's wishing to participate may text the following: CornellAlert to **67283** and you will be set up to receive alert messages. Be advised that you may stop receiving messages at any time by sending "stop" to CornellAlert. There will also be a system generated "stop" every year on August 1st at which point you will need to send the text CornellAlert to re-enlist.

1.4 WATER USE RESTRICTION

A. The Contractor shall adhere to any University issued Water Use Restrictions in place at the time of construction.

1.5 PARKING

A. The Owner may designate an area for parking of essential Contractor vehicles on the project site.

B. The Contractor shall make all arrangements, and bear the cost, for transportation of all trade persons from the designated parking area to the construction site as necessary.

C. It should be noted that there is a fee for all parking on the Cornell University campus. The Contractor is responsible for the payment for all parking costs imposed by the Owner. The Contractor should contact the Project Manager (Alex Chevallard) for additional information. The Contractor will be required to complete a "New Construction Employee Form" for each permit requested. This form may be found at https://fcs.cornell.edu/forms-templates.

D. Contractor shall cooperate with Transportation Services and/or other authorities having jurisdiction, as follows:

1. Ensure parking by all employees of the Contractor, Subcontractors, material suppliers, and others connected with this project only within construction fence or the designated parking area.

2. Prohibit employees from parking in any other areas, roads, streets, grounds, etc.

3. Discharge any employee refusing to comply with these requirements.

4. Ensure proper transportation of personnel between the designated parking area and the construction site.

E. The Contractor shall remove from the parking area and staging area all temporary trailers, rubbish, unused materials, and other materials belonging to the Contractor or used under the Contractor's direction during construction or impairing the use or appearance of the property and shall restore such areas affected by the Work to their original condition, and, in the event of its failure to do so, the same shall be removed by the Owner at the expense of the Contractor, and the Contractor shall be liable therefore.

1.6 CHANGEOVERS AND CONTINUITY OF SERVICES

A. Make all changeovers, tie-ins and removals, etc., of any part of the Work that would affect the continuity of operation of the adjacent services at approved times that will not interfere with the Owner's operations. Secure approval of Owner before proceeding.

B. Make all necessary temporary connections required to permit operation of the building services and/or equipment. Remove the connections after need has ceased.

C. The Contractor may be permitted to make changeovers during normal working hours at the Owner's discretion. Should the Contractor perform this Work outside of normal working hours, no extra payment will be made for resulting overtime expenses.

D. When connecting new facilities do not shut off any existing Mechanical/Electrical facilities or services without prior written approval of Owner's Representative.

E. The Contractor shall not, except in an emergency condition, shutdown any utility without the express permission of the Owner's Representative. Major shutdowns of utilities, affecting life safety or outside contract limit lines, will be performed by Cornell University to enable Contractor to perform required Work. Major shutdowns shall be defined as those affecting life safety or which are outside the project site limits.

F. Maintain domestic water and firewater in service at all times. No service may be out for more than twenty-four (24) hours. Maintain firewater flow capability (hose, if necessary) to all buildings and coordinate with Cornell Utilities, Cornell Environment, Health and Safety (EHS), and Authority Having Jurisdiction (AHJ).

G. All shutdowns to be scheduled a minimum of seven (7) calendar days in advance and requests shall be submitted via ePM system to the Owner's Representative.

H. IN THE EVENT OF AN EMERGENCY WHERE THE OWNER'S REPRESENTATIVE IS NOT AVAILABLE, THE CONTRACTOR SHALL DIAL 911 IMMEDIATELY.

1.7 OBSTACLES, INTERFERENCE AND COORDINATION

A. General

1. Plans show general design arrangement. Install Work substantially as indicated and verify exact location and elevations; DO NOT SCALE PLANS.

2. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevations, interferences, etc. Make necessary changes in the Work, equipment locations, etc., after notification to the Owner's Representative and Architect. Obtain approval from same, as part of Contract, to accommodate work to obstacles and interferences encountered.

3. Obtain written approval for all major changes before installing. If requested, submit drawings, detailing all such deviations or changes.

4. Exposed to view mechanical units, ductwork, conduit, pipes or other building equipment are essential parts of the artistic effect of the building design and shall be installed in locations as shown on the drawings. Conformance to given dimensions and alignments with the structural system, walls, openings, indicated centerlines are a requirement of the Contract and the Contractor shall familiarize himself with the critical nature of proper placement of these items. The Contractor shall notify the Architect of conflicts which would cause such equipment to be installed in locations other than as indicated on the Drawings. The Contractor shall not proceed with the installation of exposed to view mechanical units, ductwork, conduit, pipes, etc. until all conflicts have been identified by the Contractor and resolutions to conflicts approved by the Architect.

B. Interference

1. Install Work so that all items are operable and serviceable and avoid interfering with removal of rails, filters, belt guards and/or operation of doors, etc. Provide easy and safe access to valves, controllers, motor starters and other equipment requiring frequent attention.

1.8 EQUIPMENT ARRANGEMENTS

A. Since all equipment of equal capacity is not necessarily of same arrangement, size of construction, these Plans are prepared on basis of one manufacturer as "basis-of-design equipment", even though other manufacturers' names are mentioned.

B. If Contractor elects to use specified equipment other than "design equipment" which differs in arrangement, size, etc., the Contractor does so subject to following conditions:

1. Submit detailed drawings indicating proposed installations of equipment and showing maintenance and service space required.

2. If revised arrangement meets approval, make all required changes in the work of all trades, including but not limited to louvers, panels, structural supports, pads, etc. at no increase in Contract. Provide larger motors and any additional control devices, valves, fittings and other miscellaneous equipment required for proper operation of revised layout, and assumes responsibility for proper location of roughing in and connections by other trades.

3. If revised arrangement does not meet approval because of increase in pressure loss, possibility of increase in noise, lack of space or headroom, insufficient clearance for removal of parts, or for any other reason, provide equipment which conforms to Contract Drawings and Specifications.

1.9 EXISTING EQUIPMENT, MATERIALS, FIXTURES, ETC.

A. Where existing equipment, piping, fittings, etc. are to be removed, Contractor shall submit complete list to Owner. All items that Owner wishes to retain shall be carefully removed and salvaged and delivered to building storage where directed by Owner. Items that Owner does not wish to retain shall be removed from the site and legally disposed.

1.10 EXAMINATION OF PREMISES, DRAWINGS, ETC.

A. Before Submitting Proposal

1. Examine all Drawings and Specifications relating to work of all trades to determine scope and relation to other work.

2. Examine all existing conditions affecting compliance with Plans and Specifications, by visiting site and/or building.

3. Ascertain access to site, available storage and delivery facilities.

B. Before Commencing Work on Any Phase or in any Area

1. Verify all governing dimensions at site and/or building.

2. Inspect all adjacent work.

3. All work is to be conducted in such a manner as to cause a minimum degree of interference with the Campus' operation and academic schedule. Prior to the commencement of each phase, submit Shutdown / Demo action plans that clearly describe the steps required to safely shut down utilities, systems and infrastructure that are within the work area (or affecting the work area); and those outside the work area and within approximately 25 feet of the work area limits, as approved by the Owner. The Shutdown / Demo action plan shall identify the shut off point(s) for each utility, system and infrastructure as well as the secondary shut off point(s) to account if the primary points fail or are otherwise inaccessible. To identify shutoff points, trace each utility, system and infrastructure in the presence of the campus representative from the work area to the shutoff points and place clear label on same indicating what the shutoff point is and what it effects and whether it is the primary or secondary shut off. The Shutdown / Demo action plan shall describe the shutdown procedure, identify tools and material required for shutdown, sequence of activities required for proper shutdown, the name of the person(s) or trade(s) deemed competent to perform each activity in the shutdown sequence and names and telephone numbers of the campus staff required to provide access to shut off points, assist in the shut off or perform portions of the shutdown activities. Additionally, the plan will address the Contractor's plan for maintaining MEP to adjacent occupied areas, inclusive of planned tie-in points for any and all necessary, temporary infrastructure, alarming, monitoring etc. Submit the Shutdown / Demo action plan for review and approval at least two weeks prior to fieldwork in the work area. Fieldwork shall not begin until the Shutdown / Demo action plan is reviewed. Contractor is to assign and include a competent crew, knowledgeable of each unique system involved (i.e. Mechanic, Electrician, Sheet metal, Plumber, Controls, IT, etc.). Field investigation is to include any and all necessary ladders, scaffold, temp lighting, cutting tools, photos, labels, PPE, etc. needed to properly locate, access and label shut off points. The University is explicitly requesting heightened awareness and an earnest mitigation of impact. This requirement supplements all other contractual obligations and requires the dedication of *no less than* an aggregate 40 hours.

C. Tender of Proposal Confirms Agreement

1. All items and conditions referred to herein and/or indicated on accompanying Drawings.

2. No consideration, additional monies or time extensions will be granted for alleged misunderstanding.

D. Existing or Archived Drawings

1. Existing or Archived drawings of impacted buildings are appended in electronic format only for reference and informational purposes. These historic drawings are not to be considered contract drawings and are provided "FOR INFORMATION ONLY". The Owner makes no representation as to the accuracy of the drawings as representing current conditions.

1.11 STAND DOWN DATES

A. Strict and effective enforcement by Contractor's management and supervision of the following dates and hours is required.

1. **Stand-Down Dates** (No construction work and no deliveries on site):

   a. Commencement Weekend
      - Friday, May 22, 2026
      - Saturday, May 23, 2026
      - Sunday, May 24, 2026

   b. Reunion Weekend
      - Thursday, June 4, 2026
      - Friday, June 5, 2026
      - Saturday, June 6, 2026
      - Sunday, June 7, 2026

2. **Restricted Work Dates** (delivery & demolition restrictions but otherwise work as usual):

Friday, May 22, 2026	Commencement weekend- deliveries and work outside fence stop at noon
Thursday, Friday June 5-6, 2026	Reunion guest arrivals- no work outside fence; no demo or utility work inside fence
Friday, June 6, 2026	Reunion weekend- deliveries and work outside fence stop at noon

3. **Courses Study Time & Final Exams:** While future dates are unknown at this point, the Contractor shall assume these general timeframes for the duration of the project.

   * Contractor shall assume that the "Study Time and Final Exam" periods are accurate for the University, but that the Owner has specific exam times falling within these periods. Contractor should assume 80 hours wherein a no noise restriction applies to be used at the discretion of the Owner, but falling within the "Study Time and Final Exam" Periods noted above. Specifically, this means that absolutely no construction noise may be transmitted by virtue of this project to the lecture halls, tutorial rooms, classrooms, library, etc. during the to-be-determined 80 hour period. The Owner will provide information relative to the specific times and locations no less than two weeks in advance of scheduled exams at the Contractor's request. The 80 hours are to be included with no right to claim for additional cost or time or delays to construction schedule.

1.12 WORKING HOURS

A. Normal work hours are 7AM-dusk Monday-Saturday except during above noted restrictions. This means that Contractor shall not permit any noise generating activities that could disturb campus occupants or residents to take place outside of these hours. Should any conditions necessitate work to extend beyond these hours – Contractor may submit a detailed request with reasonable advance notice to Cornell. Cornell (at its sole discretion) may issue a written relaxation of the above but Contractor is advised never to assume that it will be granted.

B. During Construction periods, no work shall take place prior to 9AM in a Residence Hall, Fraternity, Co-Op, Sorority, or any type of Housing Unit. Residence Halls require 72 hours notification to the Student & Academic Services representative prior to entering a Residence Hall or Student Room. This does not apply to Fraternity, Co-Op or Sorority House which require 24-hour notification to the Facilities Manager.

C. Contractor shall be responsible to complete and submit a Dispensation of Hours to the Department of Labor for overtime or extended hours desired to be worked on the project as needed.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 14 00*****

SECTION 01 21 00 ALLOWANCES

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. This Section describes Allowances to be carried in the Base Bid by the Contractor.

B. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

C. The Specification Section containing the pertinent requirements of materials and methods to achieve the Work described herein. Selected materials and equipment are specified in the Contract Documents by allowances.

1.2 SUMMARY

A. Definition: An allowance is an amount determined by the Owner or calculated by the Contractor based on given quantities and stated on the Bid Proposal Submission Form.

B. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. Items covered by these allowances shall be supplied for such amounts and by such persons as the Owner may direct. All uses of the allowances will require the prior written approval of the Owner via a Field Change Authorization.

C. Types of Allowances may include:

1. Lump Sum Allowance

2. Unit Price Allowance

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work. The Contractor shall provide the Owner fourteen (14) calendar days minimum notification of date.

B. At the Owner's request, the Contractor shall obtain proposals for each allowance for use in making final selections. The Contractor shall include recommendations that are relevant to performing the Work.

C. The Contractor shall purchase products and systems selected by the Architect and Owner from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Submit time sheets and other documentation to show labor hours and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in the same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate related work and modify or adjust adjacent work as necessary to ensure that Work affected by each accepted allowance is complete and fully integrated into the Project.

B. The Contractor shall include the dollar value of each scheduled allowance number as a separate line item in the Schedule of Values and identify each allowance with Section number 01 21 00.

C. The Owner shall provide the Contractor with a Field Change Authorization prior to proceeding with the Work of an allowance.

1.6 LUMP SUM AND UNIT PRICE ALLOWANCES

A. Allowances shall include cost to the Contractor of specific products and materials ordered by the Owner or selected by the Architect under allowance and shall include applicable taxes, freight, and delivery to the Project site.

B. Included as part of each allowance are miscellaneous devices, accessory objects or similar items incidental to or required for a complete installation whether or not mentioned as part of the allowance.

C. Unless otherwise indicated, Contractor's cost for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by the Owner or selected by the Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

D. Unused Materials: Return unused materials purchased under an allowance to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

1. If requested by the Owner, retain and prepare unused materials for storage by the Owner. Deliver unused material to Owner's storage space as directed.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts and scope of work, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.

2. Prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Order related to unit-cost allowance.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, or overhead and profit. Submit claims in accordance with General Conditions, Article 4, Section 4.02 - Claims for Extra Work – Changes in Work within twenty-one (21) days of receipt of Field Change Authorization authorizing Work to proceed. The Owner will reject claims submitted later than twenty-one (21) days after such authorization.

1. Do not include Contractor's or Subcontractor's indirect expenses in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expenses is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1 Field Order Allowance

Lump Sum Allowance: Include the sum of $550,000 (FIVE HUNDRED FIFTY FIVE THOUSAND DOLLARS) for a Field Order Allowance.

Allowance amount shall cover the cost of additional labor, materials, and time for contingent activities within the scope of work as directed by the University in writing in a Field Order. The Field Order will include a description of the work and the method for determining the value of the work. The value of the work directed under this allowance will be determined by one or more of the provisions of Article 4 in the General Conditions. If the net cost of all Field Orders issued are more or less than the specified amount of the allowance, the Contract amount will be adjusted by Change Order. Overhead and profit is included in this amount.

*****END OF SECTION 01 21 00*****

SECTION 01 25 00 SUBSTITUTIONS AND PRODUCT OPTIONS

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish and install the products specified, under the options and conditions for substitutions stated in this Section.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions that are beyond the Contractor's control, such as unavailability of product, or regulatory changes.

a. Products that are not available from Contractor's preferred suppliers does not constitute unavailability of product.

2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

B. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

2. New Products: Items that have not previously been incorporated into another project or facility. Items salvaged from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.

3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

C. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. In addition to submission of Substitution Request Form, substitutions shall be listed on the Bid Proposal Submission Form with description, specification references, and corresponding change in base bid

1.4 PRODUCTS LIST

A. Within thirty (30) days after the award of Contract, submit to the Architect a complete list of products which are proposed for installation.

B. Tabulate the products by listing under each specification section title and number.

C. For products specified only by reference standards, list for each such product:

1. Name and address of the manufacturer.

2. Trade name.

3. Model or catalog designation.

4. Manufacturer's data:

a. Reference standards.

b. Performance test data.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

B. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Contractor is responsible for providing products and construction methods compatible with other products and construction methods.

2. If a dispute or compatibility issue arises over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected Work as necessary to integrate Work of accepted substitutions and approved comparable products.

1.7 EQUIVALENTS – APPROVED EQUAL

A. Equivalents or Approvals - General

1. The words “similar and equal to”, or “or equal”, “equivalent” and such other words of similar content and meaning shall for the purposes of this Contract be deemed to mean similar or equivalent to one of the named products. For the purposes of Paragraph A and B of this Section 1.4 and for the purposes of Bidding Documents, the word “products” shall be deemed to include the words “articles”, “materials”, “items”, “equipment” and “methods”. Whenever in the Contract documents one or more products are specified, the words “similar and equal to” shall be deemed inserted.

2. Whenever any product is specified in the Contract documents by a reference to the name, trade name, make or catalog number of any manufacturer or supplier, the intent is not to limit competition, but to establish a standard of quality which the Architect has determined is necessary for the Project. The Contractor may at its option use any product other than that specified in the Contract Documents provided the same is approved by the Architect in accordance with the procedures set forth in Paragraph B of this Section 1.4. In all cases the Architect shall be the sole judge as to whether a proposed product is to be approved and the Contractor shall have the burden of proving, at its own cost and expense, to the satisfaction of the Architect, that the proposed product is similar and equal to the named product. In making such determination the Architect may establish such objective and appearance criteria as it may deem proper that the proposed product must meet in order for it to be approved.

3. Nothing in the Contract Documents shall be construed as representing, expressly or implied, that the named product is available or that there is or there is not a product similar and equal to any of the named products and the Contractor shall have and make no claim by reason of the availability or lack of availability of the named product or of a product similar and equal to any named product.

4. The Contractor shall have and make no claim for an extension of time or for damages by reason of the time taken by the Architect or by reason of the failure of the Architect to approve a product proposed by the Contractor.

5. Request for approval of proposed equivalents will be received by the Architect only from the Contractor.

B. Equivalents or Approvals After Bidding

1. Request for approval of proposed equivalents will be considered by the Architect after bidding only in the following cases: (a) the named product cannot be obtained by the Contractor because of strikes, lockouts, bankruptcies or discontinuance of manufacturer and the Contractor makes a written request to the Architect for consideration of the proposed equivalent within ten (10) calendar days of the date it ascertains it cannot obtain the named product; or (b) the proposed equivalent is superior, in the opinion of the Architect, to the named product; or (c) the proposed equivalent, in the opinion of the Architect, is equal to the named product and its use is to the advantage of the Owner, e.g., the Owner receives an equitable credit, acceptable to it, as a result of the estimated cost savings to the Contractor from the use of the proposed equivalent or the Owner determines that the Contractor has not failed to act diligently in placing the necessary purchase orders and a savings in the time required for the completion of the construction of the Project should result from the use of the proposed equivalent; or (d) the proposed equivalent, in the opinion of the Architect, is equal to the named product and less than ninety (90) calendar days have elapsed since the Notice of Award of the Contract.

2. Where the Architect pursuant to the provisions of this Section 1.4 approves a product proposed by the Contractor and such proposed product requires a revision or redesign of any part of the Work covered by this Contract, all such revision and redesign and all new Drawings and details required therefore shall be subject to approval of the Architect and shall be provided by the Contractor at its own cost and expense.

3. Where the Architect pursuant to the provisions of this Section approves a product proposed by the Contractor and such proposed product requires a different quantity and/or arrangement of ductwork, piping, wiring, conduit or any other part of the Work from that specified, detailed or indicated in the Contract Documents, the contractor shall provide the same at its own cost and expense.

1.8 CONTRACTOR'S OPTIONS

A. For products specified only by reference standard, select any product meeting that standard, by any manufacturer.

B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named.

1. Products:

a. Restricted List (Products): Where Specifications include paragraphs or subparagraphs titled “Products” or that include the phrase “provide one of the following”, and include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products for Contractor's convenience will not be considered.

- Substitutions may be considered, unless otherwise indicated.

b. Non-restricted List (Available Products): Where Specifications include paragraphs or subparagraphs titled "Available Products" or that include the phrase "include, but are not limited to, the following", and include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

2. Manufacturers:

a. Restricted List (Manufacturers): Where Specifications include paragraphs or subparagraphs titled "Manufacturers" or that include the phrase "provide products by one of the following", and include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products for Contractor's convenience will not be considered.

- Substitutions may be considered, unless otherwise indicated.

b. Non-restricted List (Available Manufacturers): Where Specifications include paragraphs or subparagraphs titled "Available Manufacturers" or that include the phrase "include, but are not limited to, the following", and include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Contractors shall be responsible for accommodating differences in dimensions, connection locations, and other information in order to effect a complete functioning system should a component other than basis of design be submitted.

a. Restricted List (List of Manufacturers): Where Specifications include paragraphs or subparagraphs titled "Basis-of-Design Product", and include a list of other manufacturers' names, provide the specified or indicated product or a comparable product by one of the other named manufacturers that complies with requirements.

- Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- Substitutions may be considered, unless otherwise indicated.

b. Non-restricted List (No List of Manufacturers): Where Specifications include paragraphs or subparagraphs titled “Basis-of-Design Product”, and do not include a list of other manufacturers’ names, provide the specified or indicated product or a comparable product by another manufacturer that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

C. For products specified by naming one or more products or manufacturers and stating "or equal", the Contractor shall submit a request as for substitutions, for any product or manufacturer not specifically named. Such substitution shall have been listed on Bid Proposal Submission Form as required in Instructions to Bidders. If not so listed, no substitution will be allowed.

D. For products specified by naming only one product and manufacturer, no option and no substitution will be considered unless listed on the Bid Proposal Submission Form as provided in the Instructions to Bidders. Base Bid must include the specified product or manufacturer. Substitutions will be at the sole discretion of the Owner.

1.9 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 21 days prior to time required for preparation and review of related submittals.

B. Substitutions for Convenience: Submit requests for substitution within thirty (30) days of contract award.

C. Submit a separate request for each substitution. Support each request with:

1. Completed "Request for Substitution" form in the ePM system. A request for substitution of a product, material, or process for that specified in the Contract Documents must be formally submitted as such accompanied by evidence that the proposed substitution {1} is equal in quality and serviceability to the specified item; {2} will not entail changes in detail and construction of other work; {3} will be acceptable to the Architect and Owner's Design Consultant's in achieving design and artistic intent; and {4} will not result in a cost and/or schedule disadvantage.

2. Complete data substantiating compliance of the proposed substitution with requirements stated in Contract Documents:

   a. Product identification, including manufacturer's name and address.

   b. Manufacturer's literature; identify:

      - Product description.

      - Reference standards.

      - Performance and test data.

   c. Samples, as applicable.

d. Name and address of similar projects on which product has been used, and the date of each installation.

3. An itemized comparison of the proposed substitution with the product specified listing any variations.

4. Data relating to any changes in the construction schedule.

5. The effect of the substitution on each separate contract of the Project.

6. List any changes required in other work or projects.

7. Designate any required license fees or royalties.

8. Designate availability of maintenance services, and source of replacement materials.

D. Substitutions shall not result in additions to the Contract Sum.

E. Substitutions will not be considered as having been accepted when:

1. They are indicated or implied on shop drawings or product data submittals without a formal request from the Contractor.

2. They are requested by a Subcontractor or supplier.

3. The acceptance will require substantial revision of Contract Documents.

F. Substitute products shall not be ordered or installed without written acceptance of the Owner.

G. The Owner and the Architect shall be the sole judges of the acceptability of a proposed substitution.

1.10 COMPARABLE PRODUCTS

A. Conditions for Consideration: Contractor's request for approval of comparable product will be considered when the following conditions are satisfied. If the following conditions are not satisfied, Architect may reject or return requests without action, except to record noncompliance with these requirements. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product or manufacturer:

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the product specified.

3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

5. Samples, if requested.

1.11 CONTRACTOR'S REPRESENTATION

A. In making a formal request for a substitution the Contractor represents that:

1. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor thereby represents that he has determined and verified all dimensions, quantities, field dimensions, relations to existing work, coordination with work to be installed later, coordination with information on previous Shop Drawings, Product Data, or Samples and compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor.

2. The Contractor has personally investigated the proposed product and has determined that it is equal to or superior in all respects to that specified.

3. The Contractor will provide the same warranties or bonds for the substitution as for the product specified.

4. The Contractor will coordinate the installation of an accepted substitution into the Work, and will make such changes as may be required for the Work to be complete in all respects.

5. The Contractor waives all claims for additional costs related to the substitution which may subsequently become apparent.

1.12 ARCHITECT'S DUTIES

A. Review Contractor's requests for substitutions with reasonable promptness.

B. Transmit evaluations and recommendations to the Owner, so that the Owner can notify the Contractor of the decision for acceptance or rejection of the request for substitution.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 25 00*****

SECTION 01 31 19 PROJECT MEETINGS

1.0 GENERAL

1.1 DESCRIPTION

A. The Owner will schedule and administer pre-construction meeting, periodic progress meetings, and specially called meetings throughout the progress of the Work.

1. Prepare agenda for meetings.
2. Distribute notice of each meeting no less than four calendar days in advance
3. Make physical arrangements for meetings.
4. Preside at meetings.
5. Record the minutes; include all significant proceedings and decisions.
6. Upload copies of minutes after each meeting to all participants in the meeting.

B. Representatives of Contractor, Subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.2 PRE-CONSTRUCTION MEETING

A. Schedule at least fifteen (15) days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties.

C. Attendance:

1. Owner's Representative(s)
2. Contractor(s)
3. Architect and its professional consultants
4. Major Subcontractors
5. Major suppliers
6. Safety Representatives for the Owner and Contractor
7. Commissioning Agent

D. Minimum Agenda:

1. Distribution and discussion of:
    a. List of major Subcontractors and suppliers
    b. Projected Construction Schedules
2. Critical work sequencing
    a. Identification of major shutdowns and approximate schedule
3. Major equipment deliveries and priorities
4. Project Coordination
    a. Designation of responsible personnel
5. Procedures and processing of:
    a. Field decisions
    b. Proposal requests
    c. Submittals
    d. Change Orders
    e. Applications for Payment
    f. Requests for Information
    g. Daily Reports
6. Adequacy of distribution of Contract Documents
7. Procedures for maintaining Record Documents
8. Use of premises:
    a. Office, work and storage areas
    b. Owner's requirements
    c. Job site personnel conduct
    d. Building access and security
9. Temporary facilities, controls and construction aids
    a. Storm Water Pollution Prevention Plan (SWPPP)
10. Temporary utilities

11. Safety and first-aid procedures

    a. Contractor's Project Site Specific Plan

    b. Plan as applicable to high impact respiratory pathogen pandemics and contagions (HIRPP)

12. Security procedures

13. Housekeeping procedures

1.3 PROGRESS MEETINGS

A. Schedule regular periodic meetings on the site, not less than once every two weeks throughout the Construction period.

B. Attendance:

1. Architect

2. Architect's professional consultants when, in the opinion of the Owner, needed

3. General Contractor, including Site Superintendent

4. Owner's Representatives

5. Commissioning Agent, as appropriate to agenda

6. Subcontractors as appropriate to the agenda

7. Suppliers as appropriate to the agenda

8. Safety Representative

C. Minimum Agenda:

1. Review, approval of minutes of previous meeting

2. Review percentage of work to be in place by next meeting by individual trades

3. Review of work progress since previous meeting

4. Field observations, problems, and conflicts

5. Problems which impede Construction Schedule

6. Review of off-site fabrication, delivery schedules

7. Corrective measures and procedures to regain projected schedule

8. Revisions to Construction Schedule

9. Planned progress and schedule, during succeeding work period

10. Coordination of schedules

11. Review submittal schedules; expedite as required

12. Maintenance of quality standards

13. Building Commissioning

14. Review status of all issued proposal requests and change orders

15. Review proposed changes for:

    a. Effect on Construction Schedule and on completion date

    b. Effect on other contracts of the Project

16. Other business

D. All decisions, instructions, and interpretations given by the Architect/Engineer or its representative at these meetings shall be binding and conclusive on the Contractor.

1.4 PRE-INSTALLATION MEETING(S)

A. The Contractor to hold pre-installation meetings where required by individual specification sections or others at the discretion of the Owner. Minimum attendees would be Architect and/or their specific sub-consultant, Owner, Contractor, Subcontractor, key Suppliers, testing & inspection firm, Facilities Engineering subject matter expert, etc. Minimum agenda would include review of key submittals, RFI's, safety, logistics, material procurement, quality control, etc. Contractor to assemble and distribute the Agenda minimum 48 hours prior to meeting as well as distribute meeting minutes a minimum of seven (7) calendar days after the meeting.

B. Submit a list of pre-installation meetings with preliminary dates within fifteen (15) days of issuance of the Notice to Proceed.

1.5 COMMISSIONING MEETINGS

A. The Commissioning (Cx) Agent will schedule and conduct Cx coordination meetings as noted below.

1. Kick-off Meeting near the beginning of construction

2. TAB/ATC coordination meeting prior to commencement of TAB services

3. Routine commissioning meetings during the Acceptance Phase on a not less than bi-weekly basis.

B. Attendance:

1. Architect's professional consultants when, in the opinion of the Owner, needed

2. General Contractor, including Site Superintendent

3. Owner's Representative
4. Commissioning Agent
5. Subcontractors involved in the Cx process
    a. Mechanical Contractor
    b. Electrical Contractor
    c. ATC Contractor
    d. TAB Contractor
    e. Fire Alarm Contractor
    f. Suppliers as appropriate to the agenda

C. Minimum Agenda:

1. Review, approval of minutes of previous Commissioning Meetings
2. Schedule update
3. Action items
4. Update Cx Record
5. New Issues
6. Coordination and look ahead until next meeting
7. Other business of significance that affects commissioning goals

D. All decisions, instructions, and interpretations given by the Owner's Commissioning Agent or its representative at these meetings shall be binding and conclusive on the Contractor.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

******END OF SECTION 01 31 19******

SECTION 01 31 50 ELECTRONIC PROJECT MANAGEMENT

1.0 GENERAL

1.1 SUMMARY

A. Owner Provided System: The Contractor will utilize the Owner's electronic Project Management (ePM) system on this project.

1. The Owner shall manage the day to day use of the Owner provided ePM system and organize the training, support and maintenance of the ePM Website System for the entire project team for the period of its use on the Project.

B. There are no fees to utilize this system.

1.2 RELATED SECTIONS

A. General Conditions Article 9 – Coordination and Cooperation.

B. Section 01 33 00 – Submittal Procedures

1.3 DEFINITIONS

A. ePM: defined as an internet-based information and project communication system that allows the entire project team to collaborate in a centralized and secured repository. All project-specific correspondence, workflow processes, and documentation will be stored and routed within the ePM system.

1.4 PROCEDURES

A. Users will be provided a username and password. The Contractor shall log into the ePM system to enter the Project Documentation listed in section 2.0. All correspondence should be communicated through the e-PM system.

B. Training

1. The Owner will hold training sessions to familiarize team members with the system, and all Contractor staff are expected to attend one of these sessions or otherwise receive proper training on the system's use. All cost for personnel time and travel to attend the training as needed shall be included in the Contractor's proposal

C. The Contractor shall provide on-site personnel with personal computer(s) and personal computer equipment that will allow the Contractor's personnel to access and use the ePM Website System in a timely and efficient manner. At a minimum the Contractor is to provide the following equipment and software:

1. Web Browser: with high-speed connection, up/downloading capability

2. Device that is able to scan documents and take photographs

3. Portable Document Format (PDF) Reader/writer software

D. Contractor shall log on to the ePM Website System on a daily basis, and as necessary to be kept fully appraised of the project developments, correspondence, assigned tasks and other matters that occur on the site. These may include but are not limited to RFI's, action items, meeting minutes, discussion threads, schedule updates, submittals, submittal log, punch list items, daily reports, site photos and/or videos and pre-construction surveys.

1.5 PROCESS OVERVIEW

A. The Contractor is required to timely and accurately post, review, respond, and collaborate with other team members using the following features and/or workflow processes within the ePM system.

B. Project Team Directory – Contractor shall provide an updated directory of contact information for all companies, Subcontractors and project team members who are engaged on this project.

C. Request for Information (RFI): All project RFI's will be submitted using the ePM Website System. The submission of a Request for Information (RFI) is the Contractor's exclusive means of requesting information from the Owner and/or Architect. Attachments to RFI's (which may include sketches, photographs, documentation, and the like, will be uploaded to the ePM Website System and attached to the RFI electronically.

D. Meeting Minutes: Contractor and/or Owner shall enter meeting agendas, records and minutes in the ePM system for all applicable meetings as designated by the Owner.

E. General Communications, memorandums and Letters (Project Correspondence): Shall be created in or posted to the ePM Website System in PDF format electronically linked to action items. These action items shall include names of party (ies) required to respond, time frame within which action is to be taken and any solutions the Contractor recommends.

F. Drawings and Specifications: The Contract Documents will be posted to the ePM Website System as directed by the Owner. The Owner shall retain the right to assign download rights to active CAD or model files. CAD or model files, in any format, posted to the ePM Website System are for viewing and printing only and cannot be edited.

G. Submittals: All submittals shall be fully electronic. Reference Section 01 33 00.

H. Submittal Schedule and Log: Contractor shall post and/or update on a daily basis.

I. Field Reporting: The Contractor shall post and/or update on a daily basis all reports required by other specification sections. These reports include, but are not limited to, daily construction reports, material location reports, unusual event reports, safety and accident reports.

J. Project Photographs: Contractor shall upload project photographs to the ePM system, field by date and type including but not limited to:

1. General Progress Photographs

2. RFI Issues

3. Non-Conforming Work

4. Special Events

5. As required by individual Specification Sections

K. Project Schedule: The contractor shall post, distribute, review, and/or respond to the project schedule, monthly updates, and any other schedule submittals onto the ePM in both native and PDF formats.

L. Permits & Approvals: Contractor shall upload and maintain current copies of all permits and agency approvals that relate to the project.

M. Issue Tracking: Contractor to log and respond to issues that are related and affect other stakeholders within the project team.

N. Quality Assurance: The Owner and/or Architect will issue reports on conforming items in the ePM system. The Contractor is required to review and respond with corrective actions in the system.

O. Change Management – Cost Events and Change Orders will be managed by the e-PM system and the Contractor shall be responsible for reporting potential changes and logging Requests for Change Orders in the system. The Contractor shall also upload and manage all documentation supporting Requested Change Orders.

P. Pay Applications Requests (Invoices) – The Contractor shall create and submit invoices for review by the Owner. Once the invoices are agreed to by the Owner then the invoices should be submitted electronically per the instructions for the ePM system.

Q. Budget and Cost Management – Contractor to provide estimates and Work Breakdown Structure (WBS) to provide Owner with accurate budget/cost analysis.

1.6 ADDITIONAL INFORMATION

A. The Owner may change the standards for distribution and process prescribed above as required to suit the project.

B. The Owner shall retain ownership of all data entered into either system and shall administrate and distribute all information contained therein.

C. The Contractor shall make certain that all Subcontractors performing significant Work on the Project shall actively participate in the ePM system. Requirements for participation in the ePM system shall be made part of each bid document and final contract.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

******END OF SECTION 01 31 50*****

SECTION 01 32 16 CONSTRUCTION SCHEDULE

1.0 GENERAL

1.1 SUMMARY

A. This Section establishes the Contractor's obligation to prepare, use and update a Critical Path Method ("CPM") network plan for the entire Work and related activities which are essential to the progress of the Work to be designated as the Project Schedule. This Section describes the requirements for development, approval, utilization, and updating of the Project Schedule.

B. Submit monthly Project Schedule updates.

C. Submit to Owner and Architect a cash flow projection in accordance with Schedule of Values.

D. Submit electronic versions of all schedules, including updates, as well as all back-up to the submitted schedules.

1.2 RELATED SECTIONS

A. General Conditions Article 5 – Time of Completion.

B. General Conditions Article 9 – Coordination and Cooperation.

C. Section 01 33 00 – Submittal Procedures.

1.3 DEFINITIONS

A. Critical Path Method (CPM): A method of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the Project.

B. Critical Path: The longest continuous chain of activities through the network at a given data date for the Schedule to a Contract Milestone or Contract Completion. Where the path to a specific Milestone has become negative, the Critical Path shall be the longest continuous chain of activities with the greatest amount of negative float.

C. Near Critical Path: Any continuous series of activities through the network to the Contract Milestone or the Contract Completion Date where the Total Float of the activity at the data date along that path is within 10 days of the Total Float possessed by the activity at the data date along the Critical Path.

D. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path.

2. Predecessor activity is an activity that must be completed before a given activity can be started.

E. Milestone: A key or critical point in time for reference or measurement.

F. Float is the measure of flexibility in an activity. Float time belongs to the Project.

1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

2. Total float is the amount of time in starting or completing an activity without adversely affecting the planned project completion date, or an interim milestone that has a constraint.

G. Fragnet: The sequence of new activity(ies) and/or activity revisions, logic or resource changes that are proposed to be added to the existing schedule to demonstrate the influence of impacts to the schedule. The Fragnet shall identify the predecessors to the new activities and demonstrate the impacts to successor activities.

2.0 PRODUCTS

2.1 SCHEDULING SOFTWARE

A. The Contractor shall use the current version of Primavera Project Planner, Microsoft Projects, or other software approved in writing by the Owner to develop and update the Project Schedule, and all submissions of Project Schedule data in electronic form required in this Section shall be in Primavera Project Planner format. An alternate program may be proposed as a substitute “or equal” program to the Owner for review.

B. In order to be acceptable as a substitute for the use of Primavera Project Planner, the Contractor's software must be capable of exporting all Project Schedule data in a format that may be opened, read, and modified using the current version of Primavera Project Planner without loss of functionality or information.

C. Terms used herein with reference to the Project Schedule shall have the same definitions as those used within the Primavera Project Planner software.

3.0 EXECUTION

3.1 PROJECT SCHEDULE REQUIREMENTS MEETING

A. The Contractor shall meet with the Owner within five (5) workdays after notice to proceed to conduct a joint review of the Project Schedule requirements in this section.

3.2 SCHEDULE SUBMISSIONS

A. General Requirements:

1. Prepare a Critical Path Method (CPM) Project Schedule

2. Activity durations shall be in units of whole workdays. Unless a longer duration is approved by the Owner, durations for activities other than submittal and procurement activities shall not exceed fifteen (15) workdays.

3. Except for the first and last activities in the Project Schedule, each activity shall have at least one predecessor and one successor relationship to form a logically connected network plan from Notice to Proceed (NTP) to the Contract completion date.

4. Each activity shall be cost and resource loaded. Labor, material and equipment shall be clearly identified and valued.

5. The Contractor shall provide the native electronic files of the CPM schedule, graphics, cost and resource reports required under this Section and/or as requested by the Owner at no additional cost throughout the entire project performance period until Project completion is achieved. Contractor shall also provide all documents in PDF electronically created from the native files to PDFs (not scans).

B. Preliminary Schedule:

1. Within twenty one (21) calendar days of Notice to Proceed ("NTP"), the Contractor shall submit a Preliminary Schedule in the form and requirements specified in 3.4 with respect to the planned work activities to be performed during the first one hundred twenty (120) calendar days following NTP. Activities beyond the first on hundred twenty (120) calendar days may be depicted in summary form.

2. The Owner will review schedules and return review copy within ten (10) days after receipt.

3. If required, resubmit within seven (7) days after return of review copy.

C. Baseline Project Schedule:

1. Within sixty (60) calendar days following NTP, the Contractor shall submit a proposed Project Schedule in the form specified in 3.4.

2. The Owner will review schedules and return review copy within ten (10) days after receipt.

3. If required, resubmit within seven (7) days after return of review copy.

D. Technical Requirements:

1. Show the complete sequence of construction by activity.

2. At a minimum show the dates for the beginning, and completion of, each major element of construction. Specifically list:

   a. All submittal and review activities, including preparation of shop drawings, calculations, samples, and mockups, testing of mockups, and Owner review of submittals;

   b. All procurement activities, including awarding of subcontracts and fabrication, testing, and delivery of materials and equipment;

   c. All field activities, including mobilization, demobilization, construction, site clearing, site utilities, foundation work, structural framing, Subcontractor work, equipment installations, finishes, pre-installation meetings, start-up, testing, balancing, commissioning, and punchlist.

3. Show projected percentages of completion for each item, as of the first day of each month.

4. Show estimated dates for the beginning and completion of work which must be completed by or coordinated with the Owner such as hazardous materials abatement, moving, training and other such items as they are identified.

E. Submittals Schedule for Shop Drawings, Product Data and Samples: Submit Submittals Schedule within thirty (30) calendar days after date of commencement of work. Confer with the Architect and agree on all elements of the Submittals Schedule. The schedule will be based on the understanding that minimum turn-around time in the Architect's office is ten (10) working days. Some submittals or groups of submittals may take longer to review. Submittals which do not conform to the agreed schedule may be subject to delays in processing. Show:

1. The dates for Contractor's submittals.

2. The dates reviewed submittals will be required from the Architect.

3. Confirmed lead time for manufacturing, production, fabrication and shipment to the project site of all materials which have an impact on the critical path of the Project's construction schedule.

3.3 SCHEDULE UPDATES

A. Submit progress update schedules to accompany each application for payment.

B. Indicate progress of each activity to date of submission.

C. Show changes occurring since previous submission of schedule:

1. Major changes in scope

2. Activities modified since previous submission

3. Revised projections of progress and completion

4. Other identifiable changes

D. When change orders are proposed, potential delays are anticipated, or delays are experienced, the Contractor shall submit a written Time Impact Analysis (TIA) describing the effect of each potential change order, potential delay, delay, or Contractor request on the Substantial Completion Date:

1. The TIA shall meet the requirements for submittal of a Schedule Revision with sufficient supporting documentation to enable the Owner to make a determination on the Contractor's request for time extension.

2. The TIA shall be performed by inserting a fragnet into a copy of the current schedule at the time the impact was identified or occurred.

3. All TIAs shall be incorporated into the current schedule and not prior schedules. Thus, the current schedule shall be updated, accepted, and TIAs incorporated each month.

E. All approved change orders must be incorporated in the following month's schedule update.

3.4 FORM OF SUBMISSION OF PROJECT SCHEDULE AND UPDATES

A. All proposed versions of the Project Schedule shall be submitted as follows.

1. The Contractor shall submit an electronic copy of native file and PDF versions of all generated reports.

2. The Preliminary Schedule and proposed Project Schedules shall have the NTP date as the data date, and shall reflect no progress of work activities;

3. Format of column listings: The chronological order of the start of each item of work, activity ID, activity description, early start, late start, early finish, late finish, original duration, remaining duration, percent completion, area code, responsibility code, total float, budgeted cost, budgeted quantity, and calendar ID.

4. Narrative: The Contractor shall submit a narrative including explanation of the following:

a. The contract substantial completion date;

b. The approach used to plan and sequence the Work, including considerations of site logistics, Contract Milestones, and where applicable, phasing and coordination with other contractors;

c. Steps taken to address exceptions to prior submissions; and

d. Identification of all intentional deviations from the specific requirements of this Section, together with a justification for approval of the deviation.

e. Description of the activities on the primary and secondary critical paths.

B. Project Schedule Updates shall be submitted as follows:

1. The Contractor shall submit an electronic copy of the Project Schedule Update

2. The Contractor shall submit all proposed revisions after the initial Project Baseline Schedule submission in fragnet form.

3. The Contractor shall submit with all Preliminary Schedule and Project Schedule Updates a narrative addressing the following:

a. Current projected substantial completion date and the number of days ahead/behind the contract substantial completion date;

b. Variance from prior schedule forecasted (substantial) completion date

c. Progress achieved against the planned critical path during the period;

d. Description of major work activities performed during the month prior to the Update;

e. Description of major work activities anticipated to be performed during the month following the Update;

f. The approach used to plan and sequence the Work, including considerations of site logistics, Contract milestones, and where applicable, phasing and coordination with other contractors;

g. Description of the activities on the primary and secondary critical paths during the month prior to the Update. Any changes to the primary Critical Path since the prior month's update with reason as to why it is now the critical path;

h. Sources of potential Project delay, including activities or groups of activities whose float has diminished over the course of prior Updates and their potential impact on the schedule;

i. Pending items (submittal reviews, answers to requests for information, change orders, requests for time-extensions, etc.) affecting critical path activities and activities with limited or diminishing available float;

j. All revisions introduced into the Project Schedule since the prior Update, the reason for the revision, the Activity ID of all activities affected by the revision, and the impact, if any, to the float for each such activity, as well as the Project completion date; and

k. All exceptions taken by the Owner to the Contractor's prior Update and whether they were resolved or not.

l. Identification of all intentional deviations from the specific requirements of this Section, together with a justification for approval of the deviation

m. Steps taken to address exceptions to prior submissions;

n. The effect of new changes on schedule.

3.5 DISTRIBUTION

A. Distribute copies of the reviewed schedules to:

1. Owner Job Site personnel

2. Subcontractors

3. Other concerned parties

B. Instruct recipients to report to the Contractor, in writing, any problems anticipated by the projections of the schedule.

*****END OF SECTION 01 32 16*****

SECTION 01 32 33 PHOTOGRAPHIC DOCUMENTATION

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide existing condition photographs taken before commencement of Work, progress photographs taken periodically during progress of the Work, and final photographs upon completion and full occupancy of the building.

1.2 SUBMITTALS

A. Progress Submittals

1. Key Plan: Submit key plan of Project area and building with notation of vantage points marked for location and direction of each photograph.

2. Upload digital photograph electronic files, organizationally filed by week, to the ePM system within five (5) days of taking photographs.

3. Each photograph shall be identified with project title, date, and a description of the view.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 EXISTING CONDITION PHOTOGRAPHS

A. Before commencement of selective demolition, take photographs of Project area and surrounding areas, including existing items to remain during construction.

3.2 PROGRESS PHOTOGRAPHS

A. Photographs shall be taken weekly in a manner which completely documents the Work.

B. The photographs shall be submitted to the Owner at the end of the first week for review.

C. Provide photographs of any wall, ceiling or floor assembly containing MEP, A/V or any infrastructure that will thereafter become concealed-prior to closure. Note location on Key Plan.

3.3 FINAL COMPLETION PHOTOGRAPHS

A. Photographs shall be taken in a manner which completely documents the completed Work, for submission as project record documents.

*****END OF SECTION 01 32 33*****

SECTION 01 33 00 SUBMITTAL PROCEDURES

1.0 GENERAL

1.1 DESCRIPTION

A. Section includes administrative and procedural requirements for submittals, including the following:

1. Shop Drawings
2. Product Data
3. Samples and Mock-ups
4. Quality Assurance and Quality Control Submittals
5. Coordination Drawings
6. Certification of Asbestos free products
7. Post-Construction or Post-Renovation Asbestos survey, reference Section 01 35 29.
8. Owner audio/visual
9. Owner furnishings and fixed equipment

B. Designate in the construction schedule, and/or in a separate Submittals Schedule, the dates for submission and the dates reviewed Shop Drawings, Product Data and Samples will be needed.

C. With the exception of physical samples and color charts, or as otherwise approved by the Owner, all submittals shall be electronic images in PDF format created electronically (saved with commenting allowed) which shall be submitted for review and approval via the ePM web site. PDFs shall be created directly from the native file format electronically. Scanning of paper to PDF shall be used minimally. Any non-electronic submittals shall be approved on a case by case basis and logged into the electronic management system as directed by a Cornell representative.

1.2 SUBMITTAL REGISTRY AND SCHEDULE

A. The Architect shall provide a draft submittal registry in the template needed to import into the ePM system. It will be part of the contract documents and turned over to the Contractor in native format for their use. The Contractor shall be responsible for review and completion of the registry including addition of dates identified below and other information as deemed necessary by the Owner.

B. The submittal registry and schedule shall list all submittals required by the specifications, listed in order by the specification section in which they are required. Coordinate the Submittal Schedule with the Contractor's Critical Path Method Construction Schedule and other related documents.

C. The Submittal Registry shall include the following information:

1. Title (*by Architect for Contractor review*)
2. Related specification section and paragraph numbers (*by Architect for Contractor review*)
3. Subsection (*by Architect for Contractor review*)
4. Category of Submittal (Certification, Mock-Up, Operations/Maintenance Manual, Product Data, Sample, Shop Drawing, Test Report, As Built, etc.) (*by Architect for Contractor review*)
5. Submittal Description including description of the part of the Work covered by the submittal (*by Architect for Contractor review*)
6. Name of Subcontractor, if applicable (*Contractor provided, optional*)
7. Date due from Subcontractor (*Contractor provided, optional*)
8. Date due to be submitted for review (*Contractor provided, **required***)
9. Date due for submittal review to be completed (*Contractor provided, **required***)
10. Date for transmittal to Subcontractor (*Contractor provided, optional*)
11. Date for material or product delivery to project (*Contractor provided, **required***)
12. Priority. Low, normal or high (*Contractor provided, **required***)

D. Schedule a resubmittal for each major submittal. Except where specified otherwise in the contract documents, provide review times for submittals in accordance with Submittal Procedures and Architect's Duties below.

E. Distribution: Initially submit the Submittal Schedule to the Owner for review via the ePM system. A submittal schedule compliant with the requirements of this section showing all submittals for the preliminary schedule submission duration shall be submitted with the Contractor's preliminary schedule submittal described in Section 01 32 16. The schedule shall also enumerate all submittals to be processed after the initial preliminary schedule submission duration period, although the date for these submittals does not have to be indicated. A final baseline submittal schedule showing all submittals for the entire project shall be included in the baseline schedule submittal described in section 01 32 16.

F. Updating: The Submittal Schedule shall be kept up-to-date by the Contractor until all submittals are approved. Failure to provide the requested information, or delay in submitting required submittals may result in the payment request being returned to the Contractor until the required schedule or submittals are received.

1.3 SHOP DRAWINGS

A. Drawings shall be newly prepared information drawn accurately to scale by skilled draftsperson and presented in a clear and thorough manner.

1. Highlight, encircle, or otherwise indicate deviations from Contract Documents.

2. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings.

3. Standard information prepared without specific reference to Project is not Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.

2. Identification of products and materials included by sheet and detail number.

3. Compliance with specified standards.

4. Notation of coordination requirements.

5. Notation of dimensions established by field measurements.

6. Submittal:

a. For electronic transmittal, submittals shall be distributed electronically via the ePM system and will be reviewed and returned electronically marked with action taken.

b. Maintain returned document as a “Record Document”.

1.4 PRODUCT DATA

A. Product Data includes brochures, diagrams, standard schedules, performance charts, and instructions that illustrate physical size, appearance and other characteristics of materials and equipment. All submittals shall identify all products as asbestos free, see Section 01 35 29.

B. Collect Product Data into a single submittal for each element of construction or system.

1. Clearly mark each copy to show applicable choices and options. Failure to do so will result in rejection of the submission.

2. Show performance characteristics and capacities.

3. Show dimensions and clearances required.

4. Show wiring or piping diagrams and controls.

5. Where Product Data includes information on products that are not required, eliminate or mark through information that does not apply.

6. Supplement standard information to provide information specifically applicable to the Work.

7. Preliminary Submittal: Submit single copy of Product Data where selection of options by Architect is required.

8. Submittals:

   a. For electronic transmittal, submittals shall be distributed electronically via the ePM system and will be reviewed and returned electronically marked with action taken.

1.5 SAMPLES AND MOCK-UPS

A. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

B. Office samples shall be of sufficient size and quantity to clearly illustrate:

   1. Functional characteristics of the product, with integrally related parts and attachment devices.

   2. Full range of color, texture and pattern.

C. Field samples and mock-ups:

   1. Contractor shall erect, at the Project site, at a location acceptable to the Architect.

   2. Size or area: that specified in the respective specification section.

   3. Fabricate each sample and mock-up complete and finished.

   4. Remove mock-ups and turn over to the Owner when directed by the Architect/Owner.

   5. Perform necessary work to bring any area disturbed by mock-ups to the areas original condition.

D. Submit fully fabricated Samples cured and finished as specified and physically identical with material or product proposed.

   1. Mount or display Samples in manner to facilitate review of qualities indicated.

   2. Identify Samples with generic description, product name, and name of manufacturer.

   3. Submit Samples for review and verification of size, kind, color, pattern, and texture.

   4. Where variation in color, pattern, texture, or similar characteristics is inherent in material or product represented, submit at least three (3) multiple units that show approximate limits of variations.

5. Preliminary Submittals: Submit one (1) full set of choices where Samples are submitted for Architect's selection of color, pattern, texture, or similar characteristics from a range of standard choices.

6. Submittals:

   a. Submit electronic transmittal, photograph sample and its label and attached to the submittal item electronically via the ePM system. For physical samples, submit four (4) sets for Architect's review. Architect will return at least one (1) set marked with action taken. Maintain sets of Samples, as returned, at Project Site, for quality comparisons throughout course of construction.

1.6 QUALITY ASSURANCE AND QUALITY CONTROL SUBMITTALS

A. Quality assurance and quality control submittals include design data, test reports, certifications, manufacturer's instructions, and manufacturer's field reports.

B. Professional design services or certifications: Where Contract Documents require professional design services or certifications by a design professional, Contractor shall cause such services or certifications to be provided by a qualified design professional, whose registration seal shall appear on drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Architect shall be entitled to rely upon adequacy, accuracy, and completeness of services, certifications, or approvals performed by such design professionals.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies as specified in the Contract Documents.

D. Manufacturer's instruction: Preprinted instructions concerning proper application or installation of system or product.

E. Manufacturer's field reports: Reports documenting testing and verification by manufacturer's field representative to verify compliance with manufacturer's standards or instructions.

F. Submittals:

1. For electronic transmittal, submittals shall be distributed electronically via the ePM system and will be reviewed and returned electronically marked with action taken.

1.7 COORDINATION DRAWINGS

A. The Contractor shall coordinate and manage the preparation and submittal of coordinated layouts of the mechanical, electrical and fire protection systems and equipment for all areas; drawn at a scale not less than 1/4" per foot showing on both plan and elevation including but not limited to all equipment, ducts, pipe sleeves, piping including plumbing and, sprinkler system, lighting, special supports and other items contained within the space. Show mechanical and electrical services as well as architectural and structural features drawn to scale. Provide electronic record of each coordination drawing submitted in TIFF and PDF formats to the Owner. Provide coordination drawings for all corridors, laboratories, offices, mechanical rooms, boiler room, shafts, tunnels, and all congested areas. Copies of coordination drawings shall be distributed to all trades to assure a complete, coordinated installation of work within the space available.

B. Submittal and review of coordination drawings will be required thirty (30) days prior to commencement of fabrication and/or installation of any work item.

C. Prepare and submit coordinated layouts of the mechanical and electrical systems and equipment for all areas; drawn at a scale not less than 3/8 inch =1 foot (1:32) showing on both plan and elevation including but not limited to all equipment, ducts, pipe sleeves, piping including plumbing and, sprinkler system, lighting, special supports and other items contained within the space. Show mechanical and electrical services as well as architectural and structural features drawn to scale. Provide copies of each coordination drawing submitted. Provide coordination drawings for all spaces, including but not limited to, corridors, laboratories, offices, mechanical rooms, boiler room, shafts, tunnels, and other areas. Copies of coordination drawings shall be distributed to all trades to assure a complete, coordinated installation of work within the space available.

1. Show architectural, structural and other adjacent work requiring coordination with services. Show items, including but not limited to, access doors, ceiling grids, ceiling construction, structural decks and framing, fixtures, devices, and other adjacent work coordinated with services and architectural layouts shown on Drawings.

2. Prepare plans, sections, elevations, and details as needed to describe the relationship of various systems and components. Supplement plan drawings with section drawings where required to adequately represent the Work.

3. Include room names and numbers of each space.

4. Coordinate the addition of trade-specific information to the coordination drawings by multiple entities in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

5. Contract drawings are diagrammatic. Exact location of receptacles, light fixtures, exit signs, fire alarm devices, and other devices shall be coordinated with the Architectural Drawings and shall not be scaled from locations indicated on the Mechanical and Electrical Drawings. Coordinate modifications in layout as necessary to complete the Work in accordance with the design intent.

6. Coordinate modifications in layout and components necessary to ensure maintenance accessibility and prevent conflict between each portion of the Work.

7. Maintain maximum headroom at all locations. Unless indicated otherwise, all mechanical and electrical systems and associated components are to be installed as tight to underside of structure as possible.

8. Indicate functional and spatial relationships of components of architectural, structural, mechanical, plumbing, fire protection, electrical systems, communications systems, security systems, and other portions of the Work. Drawings shall indicate dimensions, to avoid interference with existing conditions, structural frame, ceilings, partitions, services, and other portions of the Work. Where conflicts occur with placement of materials of various portions of the Work, Contractor shall be responsible to resolve conflicts and coordinate the available space to accommodate each portion of the Work. Adjustments resulting from coordination shall be initialed and dated by the entity(s) affected by the adjustments.

9. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

10. Show location and size of access doors and access panels required for access to concealed dampers, valves, and other controls.

11. Indicate required installation sequences.

12. Indicate dimensions, elevations, and alignments shown on the Drawings. Specifically note dimensions, elevations, and alignments that appear to be in conflict with submitted equipment and minimum clearance requirements and notify Architect. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

13. Indicate suspended ceiling heights and show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.

14. Indicate locations of fire-rated partitions, smoke partitions, and other required barriers.

15. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, toilet partitions, overhead-mounted equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components and notify Architect.

16. Exposed Ceiling Construction: In addition to other indicated information, show fully-dimensioned locations of all items exposed at ceiling space. Indicate alignment requirements and centerline locations of light fixtures, ducts, piping, conduit, and other services. Show dashed outline locations of laboratory casework, shelving, and other items that extend 7 feet or more above the floor.

17. Mechanical and Electrical Rooms: Provide coordination drawings for mechanical and electrical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment. Indicate paths of egress from rooms. Indicate paths for equipment removal from rooms. Indicate clear areas required for access and maintenance.

18. Structural Penetrations: Indicate scheduled and requested penetrations and openings required for all disciplines. Request un-scheduled penetrations and openings where Contractor has reviewed, analyzed, and coordinated all possible routing options and structural penetrations are only feasible option to accommodate indicated ceiling heights. Refer to the drawings for general guidelines and request confirmation by Architect for structural penetrations.

19. Mechanical and Plumbing Work: Show dimensioned locations, sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, accessories, and support systems. Show locations of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

20. Electrical Work: Show electrical distribution, systems, equipment, and runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger. Show light fixture, exit light, emergency battery pack, smoke detector, fire alarm, and other device locations. Show panel board, switch board, switchgear, transformer, bus way, generator, and motor control center locations. Show location of pull boxes and junction boxes, dimensioned from column center lines. Show lighting control systems. Show cable tray layouts including vertical and horizontal offsets and transitions, clearances for access above and to side of cable trays, and vertical elevation of cable trays above the floor or bottom of ceiling structure.

21. Fire Suppression System: Show locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

22. Refer to individual Sections for additional Coordination Drawing requirements for work in those Sections.

23. Contractor Sign-Off: Contractor and each entity performing portions of the Work shall sign and date coordination drawings.

24. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit. Review of coordination drawings shall not reduce Contractor’s responsibility for final coordination of installation and maintenance clearances of systems and equipment with existing conditions and each portion of the Work.

D. Submittal and review of coordination drawings will be required before work can start in any given area of the building.

1.8 CONTRACTOR RESPONSIBILITIES

A. Review submittals for compliance with Contract Documents and approve submittals prior to transmitting to the Architect.

B. Specifically record deviations from Contract Document requirements, including minor variations and limitation. Comply with requirements of Section 01 25 00 Substitutions and Product Options.

C. Contractor's approval of submittals shall indicate that the Contractor has determined and verified materials, field measurements and field construction criteria, and has checked and coordinated information within each submittal with requirement of the Work and Contact Documents. Field conflicts which arise from the contractor's failure to fully review and approve submittals before ordering equipment, will result in the contractor being burdened with all costs to remediate the situation.

D. Contractor shall be responsible for:

1. Compliance with the Contract Documents
2. Confirming and correlating quantities and dimensions
3. Selecting fabrication processes and techniques of construction.
4. Coordination of the work represented by each submittal with other trades.
5. Performing the Work in a safe and satisfactory manner.
6. Compliance with the approved Construction Schedule.
7. All other provisions of the agreements.

E. It is understood that the Architect's notation on the submittals is not to be construed as an authorization for additional work or additional cost.

F. If any notations represent a change to the Contract Sum, submit a cost proposal for the change in accordance with procedures specified before proceeding with the Work.

G. It is understood that the Architect's notation on the submittal is not to be construed as approval of colors. Make all color-related submittals at one time.

H. Notify the Architect by letter of any notations made by the Architect which the Contractor finds unacceptable. Resolve such issues prior to proceeding with the Work.

I. Begin no fabrication of work until all specified submittal procedures have been fulfilled.

J. Do not submit shop drawings, product data or samples representing work for which such submittals are not specified. The Architect shall not be responsible for consequences of inadvertent review of unspecified submittals.

K. The review of shop drawings shall not relieve the Contractor of the responsibility for proper construction and the furnishing of materials and labor required even though the same may not be indicated on the review shop drawings.

L. Survey and report to designated Owner Representatives that only asbestos free material is used in the execution of Work. Reference Sections 01 35 29.

1.9 SUBMITTAL PROCEDURES

A. Coordination

1. Coordinate submittals with performance of construction activities in accordance with the Submittal Schedule approved by the Architect and Owner.

2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

3. Prepare and transmit each submittal in accordance with the Submittals Schedule, agreed to by all entities involved.

4. Prepare, review, approve and transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

5. Architect's Review: Allow ten (10) working days for Architect's initial processing of each submittal requiring the Architect’s review and response, except for longer periods required as noted below, and where processing must be delayed for coordination with subsequent submittals. The Architect will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow ten (10) working days for Architect's reprocessing of each submittal. Notify the Architect when processing time for a submittal is critical to the progress of the Work, and the work would be expedited if its processing time could be shortened.

   An additional five (5) working days will be required for items specified in Divisions 2, 3, 5, 23 and 26, and for Architectural Woodwork, Hollow Metal Work and Hardware Schedules.

6. Allow time for delivery in addition to review.

7. Allow time for reprocessing each submittal.

8. No extension of Contract Time will be authorized because of failure to prepare submittals sufficiently in advance of Work to permit processing.

9. Submittals made which do not conform to the schedule are subject to delays in processing by the Architect.

10. Refer to Section 01 32 16 Construction Schedules for requirements of the Submittals Schedule.

11. Failure of the Contractor to obtain approval of Shop Drawings shall render all work thereafter performed to be at Contractor’s sole risk, cost and expense.

B. Submittal Preparation

1. Place permanent label or title block on each submittal for identification.

2. Indicate name of entity that prepared each submittal on label or title block.

3. Provide space on label or beside title block on Shop Drawings to record Contractor's stamp, initialed or signed, certifying to review of submittal, action taken, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

4. Complete all fields on submittal item details in ePM system including meaningful description.

5. Include the following information on submittal documentation:

a. Drawing, detail or specification references, including section number, as appropriate to clearly identify intended use of product.

b. Field dimensions, clearly identified as such.

c. Relation to adjacent or critical features of the work or materials.

d. Applicable standards, such as ASTM or Federal Specification numbers.

e. Provide a blank space for the Architect’s stamps

f. On transmittal, record relevant information including deviations from Contract Document requirements, including minor variations and limitations.

6. Identification of revisions on re-submittals, other than those noted by the Architect on previous submittals.

7. Shop drawings with the comment "by others" are not acceptable. All such work must specifically identify the related responsible Subcontractor.

C. Submittal Transmittal:

1. Transmit submittals via the ePM system to Architect unless otherwise noted or directed.

2. Prepare and generate transmittal in ePM system for submission of samples. Package sample and other each submittal appropriately for transmittal and handling.

1.10 RECORD SUBMITTALS

A. Provide a record copy of the submittal to the Commissioning Agent in electronic format. Record copy shall be a clean copy (free of notes from the design professional) which has been updated to reflect the “as-installed” system. Provide document in PDF format.

B. Record copy of the submittal must be forwarded to the Commissioning Agent within fourteen (14) calendar days of the final approved submittal.

C. Provide a record copy of the submittal (electronic format) for the O&M Manual.

1.11 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes noted on previous submittals.

B. Shop Drawings and Product Data:

1. Revise initial drawings or data, and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made other than those noted by the Architect.

C. Samples: Submit new samples as required for initial submittal.

1.12 ARCHITECT'S DUTIES

A. Review submittals with reasonable promptness as identified in 1.9, paragraph 5 of this Section.

B. Notations on the Submittal Review Stamp or ePM file mean the following:

1. "Approved (APP)" indicates that no deviations from the design concept have been found and Work may proceed.

2. "Approved as Noted (AAN)" indicates that deviations from the design concept which have been found are noted, and the Contractor may proceed accordingly.

3. "Revise and Resubmit (RAR)" indicates that Work covered by submittal, including purchasing, fabrication, delivery, or other activity may not proceed. Revise or prepare new submittal according to Architect's notations; resubmit without delay. Repeat if necessary to obtain different action mark.

4. "Rejected (REJ)" indicates that Work covered by submittal, including purchasing, fabrication, delivery, or other activity may not proceed. Revise or prepare new submittal according to Architect's notations; resubmit without delay. Repeat if necessary to obtain different action mark.

5. "On Hold (ONH)" is used in a very limited capacity and means that the Contractor should not take action until the reason for hold has been cleared and may be required to revise and resubmit.

6. "Not Reviewed (NRV)" is used for submittals that were submitted in error, duplicate, or other reason that does not require review by the Architect but need to be closed by the Contractor upon return to them.

7. "For Record Only (FRO)": Submittals for information or record purposes, including Quality Assurance and Quality Control Submittals, and Material Safety Data Sheets (MSDS), will not require responsive action by the Architect.

a. Architect will forward informational submittals without action.

b. Architect will reject and return informational submittals not in compliance with Contract Documents.

C. Incomplete Submittals: Architect will return incomplete submittals without action.

D. Unsolicited Submittals: Architect will return unsolicited submittals to sender without action.

E. Return submittals to Contractor for distribution, or for resubmission.

1.13 DISTRIBUTION

A. Distribute reviewed Shop Drawings and copies of Product Data when possible via the ePM system to:

1. Job site file
2. Record Documents file
3. Subcontractors
4. Installers
5. Suppliers
6. Manufacturers
7. Fabricators
8. Architect
9. Owner

B. Do not permit use of unmarked copies or rejected copies of submittals in connection with construction at Project Site or elsewhere where Work is in progress.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 33 00*****

SECTION 01 35 29 GENERAL HEALTH & SAFETY

1.0 GENERAL

1.1 DESCRIPTION

A. This Section provides requirements for general health and safety during the project. The requirements of this Section shall apply to both Contractor and all tiers of Subcontractors involved in the project.

1. General Emergency Information – It is recommended that both Contractor and all sub-tiers:

   a. Sign up for Cornell Emergency Alerts. The instructions can be found at (use the visitors section): https://emergency.cornell.edu/alert/

   b. Signup for Tompkins County Emergency alerts at: https://www2.tompkinscountyny.gov/doer/swift911alerts

   c. Cornell EHS has brief guidance on some emergency scenarios at: https://emergency.cornell.edu/eag/

B. In addition to the requirements of this Section, all laws and regulations by applicable local, state, and federal agencies shall apply to the Work of this contract. In some cases, the requirements of these Specifications may by intention exceed such legal requirements, but in no case shall this Specification be interpreted or understood to reduce or eliminate such requirements.

1.2 CONTRACTOR'S PROJECT SITE SPECIFIC PLAN

A. Contractors are required to submit a Project Site Specific Plan (PSSP) for review by Cornell University representatives before commencement of work on the site. The PSSP should address site specific information, controls and or requirements as it relates to the entire scope of work for the Project. All contractors shall use the Project Site Specific Plan Template below to develop their Project's PSSP. The template may be downloaded at:

https://ehs.cornell.edu/campus-health-safety/occupational-safety/contractor-safety

1. Within the PSSP template are example(s) to use as reference. The provided examples demonstrate Cornell University's expectations for providing detailed site-specific information, controls and requirements.

2. Project Site Specific Plan's that inadequately address site specific operations will be returned with comments for resubmission. Failure to submit a PSSP may result in delay of project and/or denial of the payment.

3. All projects must have the PSSP submitted via ePM for review and comment.

B. PSSP submittal should be submitted a minimum of ten (10) days prior to the commencement of work on site. The Contractor may opt to submit their PSSP in phases. The Contractor must submit a phase submission plan using the PSSP Submission table included in the PSSP template for approval by Owner's Representative with initial submission. Submit remaining phases no later than ten (10) days prior to the start of a new, predetermined project phase or milestone.

1. Projects having less than a ten (10) day turn-around shall coordinate their submittal with the Owner's Representative, who should coordinate with Occupational Health, Safety and Injury Prevention (OHSIP), the University Fire Marshall's Office (UFMO), applicable Authority Having Jurisdiction (AHJ) and Contract College's Codes Enforcement Official, if applicable.

C. The Contractor is responsible for its employees and its Subcontractors. Subcontractors are required to submit their PSSP to the General Contractor. The General Contractor is responsible to ensure all Subcontractor(s) PSSP's are adequate per their scope of work.

D. The General Contractor is required to ensure their project's PSSP is accurately maintained throughout the duration of the contract. Resubmission is required for any new scope elements not previously addressed by the Contractor's original PSSP.

E. Definitions:

1. Project Site Specific Plan (PSSP): A structured document that details the scope of the Contract Work and related site-specific controls, requirements and information for University and Contractor personnel. This document is not intended to be all inclusive of all applicable local, state and federal laws and regulations for which the General Contractor and its Subcontractor(s) are expected to comply.

2. Authority Having Jurisdiction (AHJ):

- The organization, office or individual responsible for approving equipment, an installation or a procedure (NYS Fire Code).

- The local government, county government or state agency responsible for the administration and enforcement of an applicable regulation or law (NYS Building Code-§202.2).

3. Occupational Health, Safety and Injury Prevention (OHSIP): A division of Cornell University's Environment, Health and Safety Department. The OHSIP division can be contacted at (607)-255-8200 or by email at askEHS@cornell.edu

4. SME: The University's subject matter expert.

1.3 AERIAL WORK PLATFORMS

A. The preferred method for Aerial Work Platforms (AWPs) boom storage is fully retracted and fully lowered to the ground.

B. In some circumstances booms may need to be stored in the air because of vandalism concerns, minimal size of storage location, etc.

1. If this is case, the area under the elevated boom must be blocked or arranged such that prevents people from walking, standing, working or parking vehicles underneath.

2. When booms are stored in the air consult the extended weather forecast. Booms should not be stored in the air during predicted high winds, or severe storms. AWPs become unstable at winds or gusts greater than 25 mph and must be fully lowered to prevent a tip-over.

1.4 ASBESTOS

A. All building materials and products provided for use in construction at Cornell University are to be free of asbestos. Materials must be surveyed by a certified environmental consultant and analyzed by an accredited laboratory either prior to installation or post installation. The results of the survey are to be reported to Cornell University Facilities Management Asbestos Coordinator. The Contractor must attach applicable Safety Data Sheets / Material Safety Data Sheets for each product documenting a 100% asbestos free status. The University may provide random testing of products for asbestos content. Any Contractor installed building materials or products found to contain asbestos shall be classified as defective work. Defective work shall be corrected by the Contractor as specified in the General Conditions.

B. Attached for the Contractor's information are asbestos reports which represent samples taken within the building.

C. Based on the above, disposal of asbestos containing material is not anticipated.

1.5 LEAD

A. Building may contain lead-based paint. The Contractor shall protect workers in accordance with OSHA regulations. The Contractor selects the means and/or methods to address the presence of lead-based paint, and must concurrently protect its workers based on the Contractor's means and/or methods. The Contractor is required to submit a lead plan that is site specific, indicating that the protective measures the Contractor proposes meet the OSHA standard 1926.62 "Lead in Construction Standards". This site-specific plan should address the particular methods the Contractor intends to protect its workers, the building occupants and the building structure based on its selection of addressing the presence of lead-based paint. The site-specific plan should be attached or written into the Lead Work Plan section of the Contractor's Project Site Specific Plan.

1.6 SITE VISITS

A. The undertaking of periodic Site Visits by Architects, Engineers or the Owner shall not be construed as supervision of actual construction, or make them responsible for the safety of any persons; or make them responsible for means, methods, techniques, sequences or procedures of construction selected by the Contractor or its Subcontractors; or make them responsible for safety programs and precautions incident to the Work, or for the safe access, visit, use, work, travel or occupancy of any person.

1.7 CONFINED SPACE

A. The Contractor shall be responsible for the identification of confined space in accordance with OSHA requirements. It is the Contractor's responsibility to engage the Project Manager who will collaborate with Environment, Health and Safety regarding questions or concerns on the confined space.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 35 29*****

Watts
Architects
&Engineers
95 Perry Street
Suite 300
Buffalo, NY 14203

May 28, 2025

Mr. Alex Chevallard
Cornell University
Humphries Service Building
639 Dryden Road
Ithaca, NY 14850

RE: Renovate Livestock Pavilion for Surge Space
Asbestos Project Monitoring & Air Sampling Services

Dear Mr. Chevallard:

The asbestos abatement work in the Livestock Pavilion, facility code 1043, located at 48 Judd Falls Road, is nearing completion. All removal of asbestos-containing materials (ACM) that was scheduled as part of the Phase 1 construction has been completed. The additional abatement of the vermiculite loose fill material above the ceiling should be completed by June 3, 2025. A final report of all abatement activities is anticipate to be provided by June 30, 2025.

Should you have any questions or need additional information, please do not hesitate to contact me (716) 472-4763.

Sincerely,

WATTS ARCHITECTS & ENGINEERS

Gregory A. Andrews, CHMM
Senior Associate

SECTION 01 35 43 GENERAL ENVIRONMENTAL REQUIREMENTS

1.0 GENERAL

1.1 DESCRIPTION

A. This Section and the listed Related Sections provides minimum requirements for the protection of the environment during the project. The requirements of this Section shall apply to both Contractor and all tiers of Subcontractors involved in the project.

B. In addition to the requirements of this Section and the listed Related Sections, all laws and regulations by applicable local, state, and federal agencies shall apply to the Work of this Contract. In some cases the requirements of these Specifications may by intention exceed such legal requirements, but in no case shall this Specification be interpreted or understood to reduce or eliminate such requirements.

C. Prior to bidding, review the entire Bidding Documents and report in writing to the Owner's Representative any error, inconsistency, or omission that may have environmental impacts.

1.2 RELATED SECTIONS

A. Section 01 35 44 – Spill Control

B. Section 01 35 45 – Refrigerant Compliance

C. Section 01 57 13 – Soil Erosion and Sediment Control

D. Section 01 57 23 – Storm Water Pollution Prevention Plan

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals:

1. Analytical laboratory sample results and material Certifications for all imported soil and granular materials ("borrow").

2. Contractor's Waste Material Disposal Plan.

3. Weight tickets from the Borrow Material Supplier.

4. Proposed methods for dewatering and construction water management.

5. Analytical laboratory sample results for all waste materials.

6. Copies of manifests for all waste materials disposed of off-site.

1.4 JOB SITE ADMINISTRATION

A. In accordance with Article 2 of the General Conditions, provide a competent supervisory representative with full authority to act for the Contractor at the site.

B. If at any time operations under the representative's supervision do not comply with this Section, or the representative is otherwise unsatisfactory to the Owner, replace, if requested by the Owner, said representative with another representative satisfactory to the Owner. There shall be no change in superintendent without the Owner's approval.

C. Remove from the Work any employee of the Contractor or any Subcontractor when so directed by the Owner. The Owner may request the removal of any employee who does not comply with these specifications.

1.5 CLEARING, SITE PREPARATION AND SITE USE

A. In accordance with Section 01 14 00, only that portion of the working area that is absolutely necessary and essential for the Work shall be cleared for construction. All clearing should be approved and performed to provide minimum practical exposure of soils.

B. The Contractor shall make every effort to avoid the destruction of plants, trees, shrubs and lawns outside the area of construction so as not to unduly disturb the ecological or environmental quality of the area.

C. Topsoil excavated as part of the Project, which can be reused as part of the Project, shall be stockpiled for future use and temporarily stabilized to prevent erosion.

1.6 SPOIL AND BORROW

A. Spoil

1. Dispose of excavated material which, in the opinion of the Owner's Representative, is unfit to be used as backfill or embankment or which is in excess of the amount required under the Contract.

2. All spoil areas shall be graded and seeded to match the surrounding area.

3. Spoil areas shall be covered and protected from erosion into adjacent storm sewers, drainage ways, land areas, or water bodies.

B. Borrow Material

1. Borrow material shall be provided from a clean source. Submittals of proposed borrow material shall be reviewed by the Owner prior to delivery on-site. Submittals shall include the quantity of materials, source location and certification by the material supplier that it is free of chemicals or other foreign matter.

1.7 NOISE AND VIBRATION

A. Limit and control the nature and extent of activities at all times to minimize the effects of noise and vibrations. Take adequate measures for keeping noise levels, as produced by construction related equipment, to safe and tolerable limits as set forth by the Occupational Safety and Health Administration (OSHA), the New York State Industrial Code Guidelines and Ordinances and all City, Town and Local ordinances. Equip all construction equipment presenting a potential noise nuisance with noise-muffling devices adequate to meet these requirements

1.8 DUST CONTROL

A. Take adequate measures for controlling dust produced by drilling, excavation, backfilling, loading, saw cutting or other means. The use of calcium chloride or petroleum-based materials for dust control is prohibited. Dust control measures are required throughout the duration of construction.

B. If, in the opinion of the Owner's Representative, the Contractor is not adequately controlling dust, the Owner will first notify the Contractor. If the Contractor does not take adequate actions necessary, the Owner may, at the Contractor's expense, employ alternative means to control dust.

C. Erect, maintain, and remove when appropriate barriers or other devices, including mechanical ventilation systems, as required by the conditions of the Work for the protection of users of the project area, the protection of the work being done, or the containment of dust and debris. All such barriers or devices shall be provided in conformance with all applicable codes, laws, and regulations including OSHA.

1.9 PROTECTION OF THE ENVIRONMENT

A. Construction procedures observed by the Contractor, its Subcontractors and other employees shall include protection of the environment, in accordance with all pertinent Cornell standards, policies, local laws, executive orders, ordinances, and federal and state regulations. Construction procedures that are prohibited in the undertaking of work associated with this Contract include, but are not limited to:

1. Dumping of spoil material or any liquid or solid pollutant into any storm or sanitary sewer, drainage way, stream sewer, any wetlands (as defined by federal and state regulations), any surface waters, or at unspecified locations.

2. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, or any surface waters.

3. Pumping of any silt-laden water from trenches or other excavations into any storm sewers, sanitary sewers, drainage ways, wetlands, or surface waters.

4. Damaging vegetation beyond the extent necessary for construction of the facilities.

5. Disposal of trees, brush, and other debris in any location on University property, unless such areas are specifically identified on the drawing or in the specifications or specifically approved by the Owner's site representative.

6. Permanent or unspecified alteration of the flow line of a stream.

7. Burning trash, project debris, or waste materials.

B. Take all necessary precautions to prevent silt or waste of any kind from entering any drainage or waterways or downstream properties as a result of the Work.

C. Runoff of potable water used for concrete curing or concrete truck or chute cleaning operations shall not be allowed to reach the storm water system or open water due to the levels of residual chlorine (New York State water quality standards, 6 NYCRR Part 703.5) and other potential contaminants. If necessary, obtain permission from the local sewer authority and collect and pump the runoff to the sanitary sewer.

D. Limit the nature and extent of any activities that could result in the release or discharge of pollutants. Report any such release or discharge immediately to the Owner's Representative and clean up spills immediately, as detailed in Section 01 35 44 – Spill Control Procedures.

1.10 TEMPORARY RE-ROUTING OF PIPING AND DUCTWORK

A. Obtain approval from the Owner's Representative prior to any temporary re-routing of piping and exhaust ductwork necessary for the completion of the Work. Submit re-routing plans to the Owner's Representative in writing.

The following shall require approval of the Owner:

1. Temporary storm, sanitary or water line connections.

2. Temporary exhaust ductwork connections where such connections may impact air emissions.

B. Instruct all personnel to observe extreme caution when working in the vicinity of mechanical equipment and piping. Personnel shall not operate or tamper with any existing valves, switches, or other devices or equipment without prior approval by the Owner's Representative.

1.11 HAZARDOUS OR TOXIC MATERIALS

A. Inform officers, employees, agents, contractors, subcontractors at every tier, and any other party which may come into contact with any hazardous or toxic materials as a result of its performance hereunder of the nature of such materials, and any health and safety or environmental risks associated therewith.

B. Do not use hazardous or toxic materials in a manner that will violate Cornell University Policies or any state, federal, or municipal environmental health and safety regulations. In situations where the risks are unclear consult with Environment, Health and Safety (EHS) for guidance.

C. Provide complete care and treatment for any injury sustained by any parties coming into contact with any hazardous or toxic materials as a result of Contractor's performance or failure to perform hereunder.

D. At the completion of project Contractor shall remove all unused chemical products and hazardous materials from campus. Transportation of these materials shall be in accordance with all federal, state, and local regulations. Request and receive written approval from EHS prior to disposal of any on-site disposal.

1.12 DISPOSAL OF WASTE MATERIAL AND TITLE

A. Prior to start of work and first payment, Contractor shall prepare and submit "Contractor Waste Material Disposal Plan" to the Owner's Representative. The plan shall identify the waste transportation and treatment, storage or disposal (TSD) companies which will manage all waste material and any site(s) for disposal of the waste material. Contractor must use this form to document waste disposal methods and locations.

B. The "Contractor Waste Material Disposal Plan" form, together with definitions associated with the form waste descriptions. Forms may be downloaded at:

https://ehs.cornell.edu/environmental-compliance/solid-waste/construction-demolition-waste

https://ehs.cornell.edu/sites/default/files/FRM-CWMDP-Contractor-Waste-Material-Disposal-Plan-IPDF.pdf

C. Contractor shall be responsible for the proper cleanup, containment, storage and disposal of any hazardous material/chemical spill occurring during its work. For Cornell University owned hazardous waste EHS will oversee, approve or effect the proper disposal. Title, risk of loss, and all other incidents of ownership to the Waste Material, shall vest in Contractor at the time Contractor or any transporter acting on its behalf takes physical possession of Waste Material. Complete and maintain full records of the chain of custody and control, including certificates of disposal or destruction, of all Waste Materials loaded, transported and/or disposed of. Deliver all such records to the Owner in accordance with applicable laws and regulations and any instructions from the Owner in a timely manner and in any event prior to final payment(s) under this Contract.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 35 43*****

SECTION 01 35 44 SPILL CONTROL

1.0 GENERAL

1.1 SPILL PREVENTION

A. In order to minimize the potential for discharge to the environment of oil, petroleum, or hazardous substances on site, the following requirements shall apply to all projects:

1. All oil, petroleum, or hazardous materials stored or relocated temporarily on site during the construction process shall be stored in such a manner as to provide protection from vehicular damage and to provide containment of leaks or spills. Horizontal diked oil storage tanks, temporary berms or barriers, or similar methods of providing secondary/spill containment shall be employed as appropriate at each site.

2. Any on-site filling or dispensing activities shall occur within an area in which a temporary berm, boom, or similar containment barrier has been placed to prevent the inadvertent discharge to the environment of harmful quantities of any products.

3. All oil, petroleum, or hazardous materials stored on site shall be located in such a manner as to minimize the potential of damage from construction operations or vehicles, away from drainage ways and environmentally sensitive areas, and in accordance with all fire and life safety codes and standards.

B. Remove immediately from the site any storage, dispensing, or operating equipment that is leaking oil or hazardous substances or is in anyway unsuitable for the safe storage of such materials.

1.2 SPILL CONTROL PROCEDURES

All Contractor personnel working at the project site shall be knowledgeable of the potential health and safety concerns associated with petroleum and other hazardous substances that could potentially be released at the project site. Following are a list of activities that should be conducted by the Contractor in the event of an oil/petroleum spill or the release of any other hazardous substance. In the event of a large quantity spill that would require cleanup procedures that are beyond the means of the Contractor, an emergency spill cleanup contractor shall be hired by the Contractor. In the event the Contractor has the personnel necessary to clean up the spill, the following procedures shall be followed:

A. Personnel discovering/responding to a spill shall:

1. Identify and locate the source of the spill. If unsafe conditions exist, leave the area, inform nearby personnel, notify the site supervisor, and initiate spill reporting (Section 1. 3).

2. Limit the discharge of product, if safely possible, by: (1) diverting discharge to a containment area; (2) creating temporary dikes with soils or other available materials; and (3) utilizing sorbent materials. If secondary containment is present, verify that valves and drains are closed prior to diverting the product to this area.

3. The individual discovering a spill shall initiate containment procedures to prevent material from reaching a potential migratory route, through implementation of the following actions, or any other methods necessary. Methods employed shall not compromise worker safety.

    a. Stop the spill at once (if possible).

    b. Extinguish sources of ignition (e.g., flames, sparks, hot surfaces, cigarettes, etc.).

    c. Clear personnel from the spill location and cordon off the area.

    d. Utilize available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread.

    e. Use sorbent materials to control the spill at the source.

    f. Construct a temporary containment dike of sorbent materials, cinder blocks, bricks, or other suitable materials to help contain the spill.

    g. Attempt to identify the character, exact source, amount, and area of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified.

    h. Assess possible hazards to human health or the environment as a result of the release, fire, or explosion.

    i. If spill response measures involve the temporary cessation of any operations, the Contractor shall monitor the affected equipment for: (1) leaks; (2) pressure buildup; (3) gas generation; or (4) ruptures in valves, pipes, or other equipment.

B. Spill Cleanup:

1. Following containment of the spill, the following spill cleanup procedures shall be initiated.

    a. Use proper waste containers.

    b. Remove bulk liquid and place material in properly labeled waste container. Be sure not to collect incompatible or reactive substances in the same container.

    c. Cleanup materials not reclaimed on-site shall be disposed of in accordance with all applicable state and federal regulations.

    d. Apply sorbent materials to pick up remaining liquid after bulk liquid has been removed. The Contractor shall not walk over spilled material. Absorbed material shall be collected and placed in a separate waste container, and shall not be mixed with bulk liquid.

e. Clean spill control equipment and containers. Replace equipment in its proper location. Restock or reorder any supplies used to clean up the spill.

f. Carefully wash spilled product from skin and clothing using soap. Change clothes, if necessary, to avoid further contact with product.

g. Disposal of all spilled product and waste generated by spill response activities shall be made off-site, and shall be arranged through the Contractor.

h. A Spill Report shall be completed, including a description of the event. A sample Spill Documentation Form is available at: https://ehs.cornell.edu/campus-health-safety/emergency-services/fire-medical-spill-response/spill-cleanup-procedure

C. Fire or Explosion:

1. In the event of a fire or explosion at the site, the Contractor shall:

a. Verify that the local fire department and the appropriate emergency response services (e.g., ambulance, police) have been notified. Confirm contact information for these services at Project Kick-off Meeting.

- For projects on the Cornell Campus call Cornell Police at (607) 255-1111 who will notify the appropriate emergency response agencies

b. Report to the scene, if safe to do so, and evaluate the situation (e.g., spill character, source, etc.). Coordinate, as necessary, with other appropriate site and emergency personnel.

c. Ensure that people are cleared from the area and all accounted.

d. Ensure that fires are safely extinguished (if possible), valves closed, and other immediate actions necessary to mitigate the emergency are addressed, if safe to do so.

e. Initiate responsible measures necessary to prevent subsequent fires, explosions, or releases from occurring or spreading to other areas of the site. These measures include stopping processes or operations, collecting, and containing released oil, or removing and isolating containers.

f. Take appropriate action to monitor for: (1) leaks; (2) pressure build-ups; (3) gas generation; or (4) ruptures in pipes, valves, or other equipment.

1.3 SPILL REPORTING AND DOCUMENTATION

In the event of a spill CALL CORNELL POLICE AT 607-255-1111 who will notify the appropriate departments within the university and coordinate with the contractor for external reporting, if required.

The contractor shall be responsible for the initiation of spill reporting and documentation procedures. All petroleum spills must be reported to **NYSDEC Spill Hotline at 1-800- 457-7362**, less than two hours following discovery. Notification must be made to Cornell Environment, Health and Safety (EHS), 607-255-8200, within 24 hours of reporting the release. The Contractor will be expected to provide EHS with the DEC issued spill number. Any petroleum spill must be reported to NYSDEC unless **ALL** of the following criteria apply:

TABLE 1
CRITERIA TO EXEMPT SPILL REPORTING

CRITERIA	DESCRIPTION
Quantity	The spill must be known to be less than 5 gallons.
Containment	The spill must be contained on an impervious surface or within an impervious structure, such that it cannot enter the environment.
Control	The spill must be under control and not reach a drain or leave the impervious surface.
Cleanup	The spill must be cleaned-up within two hours of occurrence.
Environment	The spill must not have already entered into environmental media such as soil, surface water (including storm water conveyances), sanitary sewers, or ground water.

A release of a "reportable quantity" or unknown amount of a hazardous substance must also be immediately reported to NYSDEC Spill Hotline. Spills of reportable quantities of chemicals or "harmful quantities"2 of oil to navigable waters must be reported to the federal **National Response Center, 1-800-424-8802**. Additional regulatory agency spill reporting requirements may apply depending on the material released and the media to which it is released to.

Spill Reporting Information: When making a telephone report, the caller should be prepared to provide the following information, if possible:

1. The date and time of the spill or release.

2. The identity or chemical name of the material released or spilled, including an indication of whether the material is defined as an extremely hazardous substance.

3. An estimate of the quantity of material released or spilled into the environment and the approximate duration of the event.

4. The exact location of the spill, including the name(s) of the waters involved or threatened, and/or other medium or media affected by the release or spill.

5. The source of the release or spill.

6. The name, address, and telephone number of the party in charge of, or responsible for, the facility or activity associated with the release or spill.

7. The extent of the actual and potential water pollution.

8. The name and telephone number of the person in charge of operations at the spill site.

9. The steps being taken or proposed to contain and clean up the released or spilled material and any precautions taken to minimize impacts, including evacuation.

10. The extent of injuries, if any.

11. Any known or anticipated acute or chronic health risks associated with the emergency, and information regarding necessary medical attention for exposed individuals.

12. Assistance required, if any.

If the release of a hazardous substance or oil occurs in an amount which exceeds a reportable quantity (RQ) as defined in 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302, or 6 NYCRR Part 597, then the Contractor shall do the following:

1. Call to the National Response Center shall be made by the person in charge of the site. The applicable phone numbers are 1-800-424-8802.

2. Within 14 days of the release, submit a written description of the release. The description should include: (1) a description of the release, (2) the type of material released, (3) estimated amount of the spill; (4) the date of the release, (5) an explanation of why the release occurred; and (6) a description of the measures to be implemented to prevent and control future releases.

[(1)]*Reportable Quantity*: A Reportable Quantity is the quantity of a hazardous substance or oil that triggers reporting requirements under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) (USEPA, September 1992). While the Contractor is legally responsible for knowing the risks of materials that are part of construction, members of the owner's spill response team have access to information that may help identify these quantities with you.

[(2)]*Harmful Quantity*: A Harmful Quantity of oil includes discharges that violate applicable water quality standards; cause a film, sheen, or discoloration on a water surface or adjoining shoreline; or cause a sludge or emulsion to be deposited beneath the water surface or shoreline (40 CFR 110.3).

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 35 44*****

SECTION 01 35 45 REFRIGERANT COMPLIANCE

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall be responsible and accountable for compliance with the EPA Clean Air Act (CAA) Section 608, 40 CFR Part 82 and any state or local codes for all refrigerant-related work. In general, an EPA-certified technician shall perform any activity involving refrigerant-containing equipment that includes: (1) attaching and detaching hoses and gauges to and from refrigerant containing equipment to measure pressure; (2) adding refrigerant to, or removing refrigerant from equipment; or (3) any other activity that violates the integrity of a refrigerant containing circuit (for example any activity where a refrigerant containing circuit is 'opened' in any manner).

B. Refrigerant and oil shall be recovered from any equipment that does not meet the definition of a small appliance in 40 CFR Part 82 Subpart F before removal and subsequent disposal. Small appliances (as defined in 40 CFR Part 82 Subpart F) may be removed from the site with the charge (refrigerant) intact, provided it is properly labeled and handled in such a manner so as to prevent damage to the equipment that may release refrigerant. Small Appliances are defined in 40 CFR Part 82 Subpart F as: Any appliance that is fully manufactured, charged, and hermetically sealed in a factory with five (5) pounds or less of a refrigerant, including, but not limited to, refrigerators and freezers (designed for home, commercial, or consumer use), medical or industrial research refrigeration equipment, room air conditioners (including window air conditioners, portable air conditioners, and packaged terminal air heat pumps), dehumidifiers, under-the-counter ice makers, vending machines, and drinking water coolers.

C. All new equipment installed shall utilize refrigerants compliant with both EPA and State regulations.

1.2 SUBMITTALS

A. Prior to starting construction, demolition, or service work Contractor shall provide to Owner a list of all service technicians with EPA certification numbers and level of certification. (Copies of EPA certification cards are acceptable for those who will be working on the site.)

1.3 RECORD DOCUMENTS

A. Contractor shall provide to the Owners Representative all Service Invoices (or equivalent service documentation acceptable to owner) for all work performed by EPA- certified Technicians. Service Invoices (or equivalent documentation) shall include the following information at a minimum for each piece of refrigerant containing equipment serviced:

- Date of Service
- Name of EPA-Certified Technician

- Technicians Certification Level
- Type of Equipment Serviced
- Equipment Manufacture
- Equipment Model and Serial Number
- Description of Service Performed
- Date Leak Discovered (if applicable)
- Date Leak Repaired (if applicable)
- Date Follow-Up Leak Test Performed (if applicable)
- Type of Refrigerant
- Normal System Full Charge (in pounds)
- Amount of Initial Refrigerant Charge Recovered During Service
- Amount of Recovered Refrigerant Returned to System
- Type of Additional Refrigerant Added to System
- Amount of Additional Refrigerant Charged to System
- System Charge at End of Service

B. Contractor shall provide to Cornell's Environment, Health and Safety Office and FCS Facilities Management Administration Preventative Maintenance Group, via the Owner's Representative, complete equipment documentation including: make, model number, serial number, refrigerant type and full refrigerant charge (quantity), equipment ID tag number and location (room number) for all equipment installed that does not meet the definition of a small appliance (40 CFR Part 82).

C. Contractor shall provide Owners Representative a copy of complete manifests, invoices, or other documentation showing any refrigerant removed from the project by the contractor was disposed of appropriately or reclaimed by an EPA-certified reclaimer.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 LEAK TESTING

A. All new equipment not meeting the definition of a small appliance, including packaged equipment, factory charged, field charged, split systems or field-constructed systems with field-installed refrigerant piping shall be leak tested prior to or during startup. Leak testing shall utilize appropriate leak-testing equipment.

B. Leak testing shall be conducted by an EPA-certified technician. The contractor shall provide written verification of the leak testing and results.

C. If a leak is detected, the following procedure shall be followed:

1. Notify the Owner's Site Representative (who will notify the Refrigerant Compliance Coordinator).

2. Document the leak.

3. Repair the leak.

4. Document the procedures followed.

5. Leak test to verify the leak was repaired.

6. Schedule and provide a follow-up verification leak test witnessed by a designated HVAC technician.

7. Document follow-up leak testing.

8. Repeat the above process if follow-up leak is detected.

3.2 DEMOLITION PROCEDURE FOR EQUIPMENT REMOVED BY CONTRACTOR

A. The Contractor, in contractor-provided refrigerant recovery cylinders, shall take ownership of the recovered refrigerant and transport off site to a proper disposal company or certified reclaimer.

B. Service Invoices, as described in RECORD DOCUMENTS, shall be provided.

C. The Contractor technician shall tag the unit that the refrigerant was removed.

D. Once an EPA-certified technician has removed the refrigerant and tagged the unit, a non-certified person may perform the remainder of the demolition.

*****END OF SECTION 01 35 45*****

SECTION 01 41 00 REGULATORY REQUIREMENTS

1.0 GENERAL

1.1 PERMITS AND LICENSES

A. The Contractor shall obtain, maintain and pay for all permits and licenses necessary for the execution of the Work and for the use of such work when completed. Such permits shall include but are not limited to building, electrical, plumbing, backflow prevention, dig safe, fill, street use, pavement cuts and repairs, and building demolition.

1. City of Ithaca building permit applications shall be presented for review at the regularly scheduled Owner's meeting with the Authority Having Jurisdiction (AHJ).

B. For any projects which include demolition of a structure or load-bearing elements of a structure, the Contractor is required to complete a "Notification of Demolition and Renovation" and provide this notification to the United States Environmental Protection Agency (EPA) in advance of the work as specified in 40 CFR 61.145. The Contractor shall also provide a copy of this notification to the Owner's Representative prior to any demolition.

C. All Construction / Building / Hot Work and Occupancy permits shall be issued and maintained through Jim Yarbrough (jey38@cornell.edu) the SUNY Codes Official for Contract Colleges Facilities at Cornell, at no cost to the Contractor (for SUNY projects there are no permitting costs).

D. Ithaca Fire Department Permitting:

1. A permit is required from the Ithaca Fire Department to install or substantially repair a fire suppression, fire detection, or fire alarm system as such as defined under the Uniform Code of New York State.

2. If the scope of work is classified under the Existing Building Code of NYS as Alteration –Level 1; Alteration – Level 2; Alteration – Level 3; or Addition; a permit from the Ithaca Fire Department is required for all work affecting the fire suppression, fire detection, or fire alarm system for that building. A building permit is also required for this type of work.

3. Work classified as a 'Repair' under the Existing Building Code of NYS does not require a permit from the Ithaca Fire Department.

1.2 INSPECTIONS

A. Apply for and obtain all required inspections, pay all fees and charges for same, include all service charges and other associated costs.

1.3 COMPLIANCE

A. The Contractor shall give all notices, pay all fees and comply with all laws, rules and regulations applicable to the Work.

1.4 OWNER'S REQUIREMENTS

A. The Contractor, Subcontractors, and employees of the Contractor and Subcontractors shall comply with all regulations governing conduct, access to the premises, operation of equipment and systems, and conduct while in or near the premises and shall perform the Work in such a manner as not to unreasonably interrupt or interfere with the conduct of business of the Owner.

B. Upon completion of the project, the Contractor agrees to provide the Owner with a summary of municipal permit fees paid. This shall include the name of the permits secured, the permit fees paid by the Contractor and a copy of the permit. If no permit fees were required, the Contractor shall so state, in writing, upon completion of the project.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 41 00*****

SECTION 01 42 00 REFERENCES

1.0 GENERAL

1.1 INTENT OF CONTRACT DOCUMENTS

A. Notes or instructions shown on any one Drawing, apply where applicable, to all other Drawings.

B. All references to codes, specifications and standards referred to in the Specification Sections and on the Drawings shall mean, and are intended to be, the latest edition, amendment and/or revision of such reference standard in effect as of the date of these Contract Documents.

C. Install All Work in Compliance with:

1. NYS Uniform Code
    a. International Building Code
    b. International Residential Code
    c. International Existing Building Code
    d. International Fire Code
    e. International Plumbing Code
    f. International Mechanical Code
    g. International Fuel Gas Code
    h. International Property Maintenance Code
    i. Uniform Code Supplement
2. NYS Energy Code
    a. International Energy Conservation Code
    b. ASHRAE 90.1
    c. Energy Code Supplement
3. National Electric Code
4. Occupational Safety and Health Administration (OSHA).
5. Life Safety Code NFPA 101.
6. All local ordinances
7. Plans and Specifications in excess of code requirements and not contrary to same.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and other Division 1 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. "General": Basic Contract definitions are included in the Conditions of the Contract.

B. "Contract Documents": The Contract Documents consist of the Agreement between Owner and Contractor, General Conditions, General Requirements, Drawings, Specifications, addenda issued before execution of the Agreement, other documents listed in the Agreement, and modifications issued after execution of the Agreement.

C. "The Contract": The Contract Documents form the Contract for construction and represent the entire integrated Agreement between the Owner and Contractor.

D. "The Work": The work comprises the completed construction required by the Contract Documents and includes all labor necessary to produce such construction and all materials and equipment incorporated in such construction.

E. "Owner": Cornell University a New York corporation.

F. "Architect/Engineer": The Architect or Engineer is the person lawfully licensed to practice architecture and/or engineering in the state of New York, identified as such in the Owner Contractor Agreement, and is referred to throughout the Contract Documents as if singular in number. The terms Architect and/or Engineer mean the Architect and/or his authorized representative.

G. "Contractor": The Contractor, person, firm, or corporation with whom the Construction Agreement contract is made by Owner.

H. "Subcontractor": A person, firm, or corporation, supplying labor and/or materials for work at site of the project for and under separate contract or agreement with Contractor.

I. "Delegated Design" describes a collaboration between a design professional and contractor (or subcontractor) where the contractor assumes allocated responsibility for an element or portion of the Project's design. Delegated design allocation and assignment may occur in any project delivery method and will involve a licensed professional to perform the design. The Contractor or Subcontractor allocated an element or portion of the Project's design, will submit its engineered, stamped plans to the primary design team, who will check for any conflicts with any other aspect of the Work and make new documents to be included in the Project's design record. Contractor or Subcontractor allocated a delegated design element of the Project shall provide professional liability insurance for the design work in such amounts and as is required by Owner.

J. "As Approved" or "Approved": Architect's or Owner's approval.

K. "As Directed": Owner's direction or instruction. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

L. “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as “indicated.”

M. “Regulations”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

N. “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

O. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

P. “Reinstall”. To place back into a former position.

Q. “Replace”. Provide a substitute for.

R. “Provide”: Furnish and install, complete and ready for the intended use.

S. “Concealed’: Work installed in pipe shafts, chases or recesses, behind furred walls, above ceilings, either permanent or removable.

T. “Exposed”: All capital Work not identified as concealed.

U. “Project Site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

V. “As-Built Documents”: Drawings and other records that are maintained by the Contractor to record all conditions which exist when the building construction is completed. This includes both the elements of the project itself and existing elements that are encountered during the course of project construction.

W. “Record Drawings”: Shows construction changes in the project and the final location of all services, lines, outlets, and connections including underground and concealed items. The “record” drawings shall be compiled by the Architect based on the working as-built drawings and revised in accordance with the marked up drawings submitted by the Contractor.

X. “Shop Drawings”: Drawings, diagrams, illustrations, charts, brochures, and other data that are prepared by Contractor or any Subcontractor, manufacturer, supplier or distributor, for some portion of the Work.

Y. “Samples”: Physical examples furnished to illustrate materials, equipment or workmanship, and to establish standards by which the work will be judged.

Z. “General Conditions”: The standardized contractual provisions describing the responsibilities, rights and relationships of the Owner and Contractor under the construction contract.

AA. "Contract Limit Lines": A limit line or perimeter line established on the drawings or elsewhere in the contract documents defining the boundaries of the site available to the contractor for construction purposes.

BB. "to do", "provide", "furnish", "install", etc., in these Specifications or on Drawings are directions given to the Contractor;

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the organizations responsible for the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil Available from Defense Standardization Program www.dps.dla.mil Available from General Services Administration www.gsa.gov	(215) 697-6257 (202) 619-8925

	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530

AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989

API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(334) 874-9800
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(800) 242-7405 (813) 979-1991
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772

CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSI	Cast Stone Institute www.caststone.org	(770) 972-3011
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010

EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FMG	FM Global www.fmglobal.com	(401) 275-3000
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IBR	Institute of Boiler & Radiation Manufacturers	

ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek www.intertek.com	(800) 345-3851 (713) 407-3500
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (804) 314-8955

MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550

NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	International Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788

NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NYBFU	New York Board of Fire Underwriters www.nybfu.org	(212) 227-3700
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network www.landcarenetwork.org	(800) 395-2522
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SBI	Steel Boiler Institute	
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234

SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700

TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UFPO	Underground Facilities Protective Organization www.ufpo.org	(800) 962-7962 (800) 962-7811
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCSC	Window Covering Safety Council www.windowcoverings.org	(800) 506-4636
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301
WI	Woodwork Institute www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
NEC	National Electric Code	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332

GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

2.0 PRODUCTS - NOT USED

3.0 EXECUTION - NOT USED

*****END OF SECTION 01 42 00*****

SECTION 01 45 00 QUALITY CONTROL

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide and maintain an effective Contractor Quality Control (CQC) program and perform sufficient inspections and tests of all items of Work, including those of Subcontractors, to ensure compliance with Contract Documents. Include surveillance and tests specified in the technical sections of the Specifications. Furnish appropriate facilities, instruments, and testing devices required for performance of the quality control function. Controls must be adequate to cover construction operations and be keyed to the construction sequence. Construction shall not begin until the Owner has approved the CQC program.

1.2 CONTROL OF ON-SITE CONSTRUCTION

A. Include a control system for the following phases of inspection:

1. Pre-Installation Meeting. For all sections where pre-installations are defined, the Contractor shall arrange for a pre-installation meeting. When practical, pre-installation meetings shall be scheduled to take place on the same day as regularly schedule progress meetings. The Contractor shall make available, during this meeting, all approved submittals and products.

    a. Agenda to include the following:

        i. Appointment

        ii. Appointment of official representatives of participants in the Project.

        iii. Review of existing conditions and affected work, and testing thereof as required.

        iv. Review of installation procedures and requirements.

        v. Review of environmental and site condition requirements.

        vi. Schedule of the applicable portions of the Work.

        vii. Schedule of submission of samples, color chips, and items for Owners consideration.

        viii. Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences, Section 01 50 00.

        ix. Requirements for notification for reviews. Allow a minimum of 48 hour notice to Architect for review of the Work.

x. Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests in accordance with Section 01 41 00.

xi. Delivery schedule of specified equipment.

xii. Special safety requirements and procedures.

b. The following minimum personnel shall be at the meeting:

i. Project Manager.

ii. Project Field Supervisor

iii. Subcontractor

iv. Architect's Representative

v. Owner's Representative

vi. Commissioning Agent, when applicable

vii. Testing Agency, when applicable

2. Preparatory Inspection. Perform this inspection prior to beginning work on any definable feature of Work. Include a review of contract requirements with the supervisors directly responsible for the performance of the Work; check to assure that materials, products, and equipment have been tested, submitted, and approved; check to assure that provisions have been made for required control testing; examine the work area to ascertain that preliminary work has been completed; physically examine materials and equipment to assure that they conform to shop drawings and data and that the materials and equipment are on hand.

3. Initial Inspection. Perform this inspection as soon as work commences on a representative portion of a particular feature of workmanship review control testing for compliance with contract requirements.

4. Follow-up Inspections. Perform these inspections on a regular basis to assure continuing compliance with contract requirements until completion of that particular work.

1.3 CONTROL OF OFF-SITE OPERATIONS

A. Perform factory quality control inspections for items fabricated or assembled off-site as opposed to "off-the-shelf" items. The CQC Representative at the fabricating plant shall be responsible for release of the fabricated items for shipment to the job site. The CQC Representative at the job site shall receive the item and note any damage incurred during shipment. The Contractor shall be responsible for protecting and maintaining the item in good condition throughout the period of on-site and during erection or installation. Although any item found to be faulty may be rejected before its use, final acceptance of an item by the Owner is based on its satisfactory incorporation into the Work and acceptance of the completed Project.

1.4 TESTING

A. The Owner may engage the services of an independent testing laboratory to confirm that an installed item or element of work conforms to the Specification and workmanship requirements.

1.5 OWNER'S REPRESENTATIVE

A. The Owner shall designate a Representative to monitor the progress and execution of the Work. The Representative shall have the authority to call for test samples, to approve or to reject work performed and to stop work in progress, if, in its opinion, the work is not in conformance with the Contract Documents. The Representative shall not be authorized to make changes or interpretations of the Contract Documents.

1. The Contractor shall maintain a project Deficiency/Issues Log in the ePM system to track non-conforming materials or sub-standard workmanship identified by Owner's Representative.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 45 00*****

SECTION 01 45 29 TESTING LABORATORY SERVICES

1.0 GENERAL

1.1 DESCRIPTION

A. The Owner will employ and pay for the services of an Independent Testing Laboratory to perform specified services.

1. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

B. Testing Laboratory services are specified in connection with work including but not limited to the following:

1. New York State Building Code, Chapter 17, Special Inspections

2. Concrete Reinforcement: Section 03 20 22.

3. Cast-in-place Concrete: Section 03 30 00.

4. Excavating, Filling & Grading: Section 31 23 00.

5. Structural Steel Framing: Section 05 12 00.

6. Steel Decking: Section 05 31 00.

7. Building Structure Earthwork: Section 31 20 01.

8. Soil Preparation: Section 32 91 13.

9. Asphalt Pavement: Section 32 12 16.

10. Cement Concrete Pavement: Section 32 13 13.

1.2 QUALIFICATIONS OF LABORATORY

A. Meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E329-05b, "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing ".

C. Authorized to operate in the State of New York.

D. Testing and inspections shall be performed under the direction of a Licensed Professional Engineer registered in the State of New York who shall be responsible for administering all testing and inspections and shall certify any local agency requirements.

E. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

F. Testing Equipment:

1. Calibrated at maximum 12 month intervals by devices of accuracy traceable to either:

a. National Bureau of Standards

b. Accepted values of natural physical constants.

2. Submit copy of certificate of calibration made by accredited calibration agency.

1.3 LABORATORY DUTIES

A. Cooperate with Owner, Architect and Contractor; provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance of materials with requirements of Contract Documents.

C. Promptly notify Owner, Architect and Contractor of observed irregularities or deficiencies of work or products.

D. Should Laboratory tests of material performed at specified intervals of time indicate that strengths do not meet Specification requirements, the Inspection Agency and Geotechnical Engineer shall IMMEDIATELY notify the Owner, Contractor, and Architect. The Architect shall determine whether remedial action is necessary.

E. Promptly submit a written report of each test and inspection; one copy each to Architect, Owner, Contractor, and one copy to Record Documents File. Each report shall include:

1. Date issued.

2. Project title and number.

3. Testing laboratory name, address and telephone number.

4. Name and signature of laboratory inspector.

5. Date and time of sampling or inspection.

6. Record of temperature and weather conditions.

7. Date of test.

8. Identification of product and specification section.

9. Location of sample or test in the Project.

10. Type of inspection or test.

11. Observations on compliance with Contract Documents.

F. Prepare a summary report for each category of inspection certifying that the work has been inspected and meets the Contract Documents. Specifically list all discrepancies found which have not yet been repaired or resolved.

G. Perform additional tests as required by Architect or the Owner.

1.4 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel. Provide access to Work, and Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and for which testing is specified.

C. Provide to the laboratory the approved design mixes proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Furnish copies of Products test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For Laboratory's exclusive use for storage and curing of test samples.

F. Notify laboratory a minimum of 24 hours in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse laboratory for personnel and travel expenses incurred due to Contractor's responsibility.

G. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience.

H. Employ and pay for the services of a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with Contract Documents.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 45 29*****

SECTION 01 45 33 CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

1.0 GENERAL

1.1 REQUIREMENTS

A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the *Building Code of New York State* (BCNYS).

B. Hold a Special Inspections preconstruction meeting at least seven (7) days prior to the initial planned date for start of construction.

1. Discussion shall include the following:

a. Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.

b. Responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Registered Design Professional.

c. Notification and reporting procedures.

2. Attendees shall include the Contractor, Owner's representative, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and for Architecture.

1.2 DEFINITIONS

A. Registered Design Professional: The licensed Professional Engineer or Registered Architect whose seal appears on the Construction Drawings.

B. Code Enforcement Official: The Officer or other designated authority charged with administration and enforcement of the BCNYS.

C. Testing/Inspecting Agency: An agent retained by the Special Inspector or by the Owner and coordinated by the Special Inspector, to perform some of the inspection services on behalf of the Special Inspector. (An example of an Inspecting Agent is a Geotechnical Engineer.)

D. Statement of Special Inspections: A document prepared by the Registered Design Professional and filed with and approved by the Code Enforcement Official that includes the Schedule of Special Inspections listing the materials and work requiring Special Inspections. This document includes the inspections and verifications required for the project and the individuals, agencies, and/or firms who will be retained to perform these services.

E. Continuous Special Inspection: The full-time observation of work by the Special Inspector or Testing Agency while the work is being performed.

F. Periodic Special Inspections: The part-time or intermittent observation of work by the Special Inspector or Testing Agency for work that has been or is being performed and at the completion of the Work.

1.3 QUALIFICATIONS

A. The Special Inspector and Testing/Inspecting Agency shall be accepted by the Owner.

B. Special Inspections shall be performed by agents who have relevant experience for each category of inspections indicated on the drawings.

C. Minimum qualifications of inspection agents are indicated on the drawings.

1.4 SUBMITTALS

A. The Special Inspector and Testing/Inspecting Agency shall submit to the Registered Design Professional and Code Enforcement Official for review, a copy of their qualifications including the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. The Special Inspector and Testing/Inspecting Agency shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

1.5 PAYMENT

A. The Owner will engage and pay for the services of the Special Inspector and Testing/Inspecting Agency.

B. If any materials requiring Special Inspections are fabricated in a plant not located within 200 miles of the project site, the Contractor shall be responsible for the travel expenses of the Special Inspector or Testing/Inspecting Agency.

C. The Contractor shall be responsible for the cost of any retesting or re-inspection of work failing to comply with the requirements of the Contract Documents.

1.6 OWNER RESPONSIBILITIES

A. The Owner will provide the Special Inspector with a complete set of Contract Documents sealed by the Registered Design Professional and approved by the Code Enforcement Official.

1.7 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Special Inspector and his agents so that Special Inspections and testing may be performed without hindrance.

B. As indicated in the Schedule of Special Inspections, the Contractor shall notify the Special Inspector and/or Testing/Inspecting Agency at least 48 hours in advance of a required inspection or test.

C. The Contractor shall provide incidental labor and facilities to provide access to the Work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

D. If Special Inspections or testing require the use of the Contractor's scaffolding to access work areas, the Contractor shall provide a competent person to perform the daily evaluation of the scaffolding to verify that it is safe to use. The Contractor shall notify the Special Inspector and Testing Agent of this review before each use. The Contractor is responsible for the safe assembly and stability of the scaffolding.

E. The Contractor shall keep the latest set of Construction Drawings, field sketches, accepted shop drawings, and specifications at the project site for field use by the Inspectors and Testing Technicians.

F. The Contractor shall perform remedial work (if required) and sign non-conformance reports stating that remedial work has been completed. The Contractor shall submit signed reports to the Special Inspector as Work proceeds.

G. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.

H. The Contractor shall be solely responsible for construction site safety.

1.8 LIMITS ON AUTHORITY

A. The Special Inspector or Testing/Inspecting Agency shall not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Special Inspector or Testing/Inspecting Agency shall not have control over the Contractor's means and methods of construction.

C. The Special Inspector or Testing/Inspecting Agency shall not be responsible for construction site safety.

D. The Special Inspector or Testing/Inspecting Agency shall not have the authority to stop the Work.

2.0 INSPECTIONS AND TESTING

A. The Contractor shall follow the Special Inspection requirements developed by the Registered Design Professional of Record.

3.0 DOCUMENTATION

3.1 RECORDS AND REPORTS

A. Detailed reports shall be prepared of each test or inspection. The reports shall include the following general information:

1. Project name and number.
2. Date of test or inspection.
3. Name of Testing Agency or Inspecting Agency.
4. Name of technician or inspector.
5. Weather conditions.
6. Locations and elevations of specific areas tested or inspected referenced to gridlines.
7. Description of test or inspection.
8. Reference to applicable ASTM standard.
9. Summary of observations, results, and recommendations.
10. Description of any areas or materials requiring retesting or re-inspection.

B. Concrete compressive strength test reports shall contain the following information:

1. Name of Contractor and concrete supplier.
2. Name of concrete testing service.
3. Name of technician making and testing specimens.
4. Truck number and delivery ticket number.
5. Date and location within the structure of concrete placement.
6. Concrete type, class, mix proportions of materials, and design compressive strength at 28 days.
7. Slump, air content, unit weight, and concrete temperature.
8. Total time period between batching and completion of placement for each truck.
9. Compressive strength and type of break for all tests.

C. Field reports for concrete inspection shall contain the general information noted above, plus ambient temperature and cylinder numbers.

D. Test reports for masonry materials shall include proportions, composition, and compressive strength.

3.2 COMMUNICATION

A. The Testing/Inspecting Agency shall immediately notify the Owner, Contractor, Special Inspector, and Registered Design Professional by telephone or email of any test results failing to comply with the requirements of the Contract Documents.

B. The Special Inspector shall immediately notify the Contractor of any work found to be in nonconformance with the Contract Documents during inspections. If the nonconforming work is not corrected while the Special Inspector is on-site, the Special Inspector shall notify the Owner and Registered Design Professional within 24 hours (one business day) and issue a nonconformance report. The Special Inspector may use the Special Inspection Non-Conformance Report form at the end of this section or other similar form.

C. If the nonconforming work is not corrected at the time of substantial completion of the structure or other appropriate time, the Special Inspector shall notify the Owner.

3.3 DISTRIBUTION OF REPORTS

A. The Testing/Inspecting Agency shall submit reports to the Owner, Special Inspector and the Registered Design Professional within seven (7) days of the inspection or test. Reports may be submitted in the ePM system.

B. The Special Inspector shall submit reports to the Owner and Registered Design Professional within seven (7) days of the inspections. Reports may be submitted in the ePM system

C. If requested by the Code Enforcement Official, the Special Inspector shall submit interim reports which include all inspections and tests performed since the beginning of construction or since the previous interim report. Interim reports shall be addressed to the Code Enforcement Official with copies sent to the Registered Design Professionals (Structural Engineer and Architect) and Contractor. Interim reports shall be signed by the agent performing inspections.

3.4 FINAL REPORT OF SPECIAL INSPECTIONS

A. At the completion of Work, each Testing/Inspecting Agency shall electronically submit an Agent's Final Report of Special Inspections to the Special Inspector stating that work was completed in substantial conformance with the Contract Documents and that appropriate inspections and tests were performed. The Testing/Inspecting Agency may use the Agent's Final Report of Special Inspections form provided at the end of this section or other similar form.

B. At the completion of Work, the Special Inspector shall compile all inspection and test reports generated by each Agent into a Final Report of Special Inspections. The Final Report of Special Inspections shall state that required inspections have been performed and shall itemize any nonconforming work not corrected or resolved.

C. The Special Inspector may use the Final Report of Special Inspections form provided at the end of this section or other similar form based on CASE Form 102-2001.

D. The Special Inspector shall submit The Final Report of Special Inspections to the Owner, Registered Design Professional and Code Enforcement Official prior to issuance of a Certificate of Use and Occupancy.

SPECIAL INSPECTION NON-CONFORMANCE REPORT NO.

DATE: _____

TO:

CC: Contractor:

FROM: _____, Special Inspector

PROJECT:

PART I: REFERENCE SPECIAL INSPECTION REPORT NO. _____

(*Attach copy of report*)

DESCRIPTION OF NON-CONFORMANCE:

RDP RESPONSE: (PROVIDE ATTACHMENTS IF NECESSARY)

RDP SIGNATURE _____ DATE_____

IS RE-INSPECTION BY SPECIAL INSPECTOR REQUIRED □ YES □ NO

PART II: CONTRACTOR VERIFICATION (To be completed by either the ***[General Contractor or Construction Manager]*** or Subcontractor and returned to the Special Inspector and the RDP.)

I verify that as of the date listed, the non-conforming item noted above has been corrected as required.

Date Completed _____ By _____

(Contractor's Site Representative)

AGENT'S FINAL REPORT OF SPECIAL INSPECTIONS

Project Name: _____ Special Inspector: _____

Location: _____ Agent: _____

Special Inspector's Project: _____

Agent's Project: _____

To the best of my information, knowledge, and belief, the Special Inspections or testing required for this project and designated for this Agent in the Statement of Special Inspections (which includes the Schedule of Special Inspections) submitted for permit have been performed and discovered discrepancies have been reported and resolved other than the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Respectfully submitted,
Agent of the Special Inspector

_____
(Type or print name)

_____
Signature Date

_____
Address

_____
City, State, Zip

Design Professional Seal
or Certification

FINAL REPORT OF SPECIAL INSPECTIONS
AND STRUCTURAL OBSERVATIONS

Project Name: _____

Location: _____

Owner: CORNELL UNIVERSITY
Owner's Address:

Registered Design Professionals

Architecture: *Name*
Address

Structural Engineering: *Name*
Address

Special Inspector: *Name*
Address

To the best of my information, knowledge, and belief, the Special Inspections required for this project and itemized in the Statement of Special Inspections (which includes the Schedule of Special Inspections) submitted for permit have been performed and discovered discrepancies have been reported and resolved other than the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report. Agent's Final Reports of Special Inspections are attached and are also a part of this Final Report.

Respectfully submitted,

Special Inspector

_____
(Type or print name)

_____
Signature Date

Professional Seal

*****END OF SECTION 01 45 33*****

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish, install and maintain all temporary facilities and services of every kind, as required by the Contractor and by its Subcontractors for their performance of the Work and compliance with the Contract Documents, and shall remove such facilities and complete such services upon the completion of all other work, or as Cornell University may direct.

B. The Contractor shall obtain all required permits and approvals for and shall provide, construct, or install, as well as operate, maintain, service and remove temporary facilities and services.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with Federal, State and local codes and safety regulations.

2.0 PRODUCTS

2.1 MATERIALS, GENERAL

A. Choice of materials, as suitable for the accomplishment of the intended purpose, is the Contractor's option.

B. Materials may be new or used, but must not violate requirements of applicable codes, standards and specifications.

2.2 TEMPORARY FIRST AID FACILITIES

A. Provide first aid equipment and supplies, with qualified personnel continuously available to render first aid at the site.

B. Provide a sign, posted at the telephone, listing the telephone numbers for emergency medical services: Physicians, ambulance services and hospitals.

2.3 TEMPORARY FIRE PROTECTION

A. Provide a fire protection and prevention program for employees and personnel at the site. Any fire watches as a result of construction operations are the responsibility of the Contractor. Comply with NFPA 241. Develop, manage, and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with Cornell University Fire Marshall Office (UFMO) and local fire code official and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

1. Impairments "Fire Code of NYS Section 901.7". Impairment; "the removal of fire alarm devices or sprinkler system coverage in a building." There are two different levels of impairments

   a. Partial Impairment. The removal of fire alarm devices or sprinkler system coverage via control valve in the immediate area of where work is to be performed.

      - Basic Impairment Notification will be sent to Local Authority Having Jurisdiction and FM Global.

      - No fire watch will be required unless the UFMO determines otherwise.

   b. Full System Impairment. The complete removal of a fire alarm "system" or sprinkler "system". Impairment of both the fire alarm system and sprinkler system at the same time is not allowed.

      - Full System Impairment Notification will be sent by the UFMO to local Authority Having Jurisdiction, FM Global, Ithaca Fire Department, Building Manager, Maintenance Manager, Customer Service, and Cornell Emergency Services.

      - Fire Watch staffing is the responsibility of the Contractor. The UFMO will require the Fire Watch person's name(s) and contact information to prepare the required Fire Watch Documentation Form.

B. Equipment:

1. Provide and maintain fire extinguishing equipment ready for instant use at all areas of the Project and at specific areas of critical fire hazard.

2. Hand extinguishers of the types and sizes recommended by the National Board of Fire Underwriters to control fires from particular hazards.

3. Construction period use of permanent fire protection system.

4. Water hoses connected to an adequate water pressure and supply system to reach each area or level of construction upon building enclosure or heating of the building.

5. Maintain existing standpipes and hoses for fire protection. Provide additional temporary hoses where required to comply with requirements. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles. Provide hoses of sufficient length to protect construction areas.

6. Maintain unobstructed access to fire extinguishers, fire hydrants, fire department connections, standpipes, temporary fire-protection facilities, stairways, and other access routes for emergency response personnel.

7. Where existing or temporary fire protection services are being replaced with new fire protection services, do not remove or impair existing or temporary services until new services are tested, accepted, placed into operation and use, and directed by the UFMO and AHJ.

8. At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility and systems, including connected services, and place into operation and use. Instruct key personnel on use of facilities. Protect and maintain permanent fire protection system. Repair or replace any components damaged during construction.

C. Enforce fire-safety discipline:

1. Store combustible and volatile materials in an isolated, protected location.

2. Avoid accumulations of flammable debris and waste in or about the Project.

3. Prohibit smoking in the vicinity of hazardous conditions.

4. There is NO SMOKING allowed on construction sites located in any occupied building. Smoking is prohibited in all Cornell University buildings.

5. Closely supervise welding and torch-cutting operations in the vicinity of combustible materials and volatile conditions.

6. Supervise locations and operations of portable heating units and fuel.

D. Maintain fire extinguishing equipment in working condition, with current inspection certificate attached to each extinguisher.

E. Welding or burning operations shall be conducted under a Hot Work Permit issued in accordance with Section 01 41 00. Where such work is permitted, the Contractor shall comply with Cornell EHS's *Contractor Guidelines for Hot Work* and provide an approved fire extinguisher in good operating condition within easy reach of the operating personnel. In each instance, obtain prior approval of Cornell University Environment, Health & Safety.

Contractor Guidelines for Hot Work, https://ehs.cornell.edu/campus-health-safety/fire-and-life-safety/hot-work-and-welding-safety/general-contractor-guidelines-for-hot-work

F. Advise Cornell University Environmental Health and Safety of any items affecting Life Safety, e.g., inoperable safety devices or systems, road blockages, exit closing, etc.

2.4 CONSTRUCTION AIDS

A. Provide construction aids and equipment required to assure safety for personnel and to facilitate the execution of the Work; Scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, fall protection, harness, tie-off points, and other such equipment.

B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.

C. Maintain all equipment in a safe condition.

2.5 SUPPORTS

A. The Contractor shall include cost of all materials and labor necessary to provide all supports, beams, angles, hangers, rods, bases, braces, etc. to properly support the Contract Work. All supports, etc. shall meet the approval of the Architect.

B. Any and all supports that are of "custom" fabrication or installation shall be designed by the Contractor's NYS licensed PE with stamped & signed shop drawings and calculations provided for same.

2.6 TEMPORARY ENCLOSURES

A. Provide temporary weather-tight enclosure for building exterior, maintain in-place until installation of permanent enclosures. Provide temporary weather-tight enclosure of exterior walls as work progresses for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities, and as necessary to provide acceptable working conditions, provide weather protection for interior materials, provide weather protection for occupied areas, allow for effective temporary heating, and to prevent entry of unauthorized persons.

1. Provide temporary exterior doors with self-closing hardware and padlocks or locksets.

2. Other enclosures shall be removable as necessary for work and for handling of materials.

3. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

4. Coordinate enclosure with ventilation requirements, material drying or curing requirements, and specified environmental limitations to avoid dangerous or detrimental conditions and effects.

B. Provide temporary enclosures to separate work areas from areas of the existing building occupied by Owner; to prevent penetration of dust or moisture into occupied areas, to prevent damage to existing equipment, and to protect Owner's employees and operations from construction work.

1. Temporary partition and ceiling enclosures: Framing and sheet materials which comply with structural and fire rating requirements of applicable codes and standards.

a. Close joints between sheet materials, and seal edges and intersections with existing surfaces, to prevent penetration of dust or moisture.

b. In locations where fire protection is required, paint both sides of partitions and ceilings with fire-retardant paint as required by local fire regulations.

2. Do not remove existing exterior enclosure systems until new exterior enclosure systems are ready for installation. Complete removal of existing exterior enclosure systems as soon as possible. Immediately after completing removal, install new exterior enclosure systems and complete installation as soon as possible.

3. Do not remove existing HVAC systems connected to louvers at existing exterior enclosure systems until new HVAC systems and louvers at exterior enclosure systems are ready for installation. Complete removal of existing HVAC systems and louvers as soon as possible. Immediately after completing removal, install new HVAC systems and new louvers and complete installation as soon as possible.

2.7 TEMPORARY WATER CONTROL

A. The Contractor shall provide, maintain and operate pumps required to keep the Work free of water at all times.

B. Dispose of all water with due care and shall not infringe on the rights of others on the Site, of adjacent property owners and of the public. All cost in connection with the removal of such water shall be paid by the Contractor.

2.8 TREE, PLANT AND LAWN PROTECTION

A. Preserve and protect existing trees, plants and lawns at the site which are designated to remain, and those adjacent to the site.

B. Consult with Owner, and remove agreed-on roots and branches which interfere with construction.

1. Employ certified arborist to remove, and to treat cuts.

C. Provide temporary fences to a height of six feet, around each, or around each group of trees and plants. Provide temporary lawn protection to prevent soil compaction. Reference Cornell University Design Standards and Details for wood and chain fencing below.

D. Protect root zones of trees, plants and lawn areas:

1. Do not allow vehicular traffic or parking.

2. Do not store materials or products.

3. Prevent dumping of refuse or chemically injurious materials or liquids.

4. Prevent puddling or continuous running water.

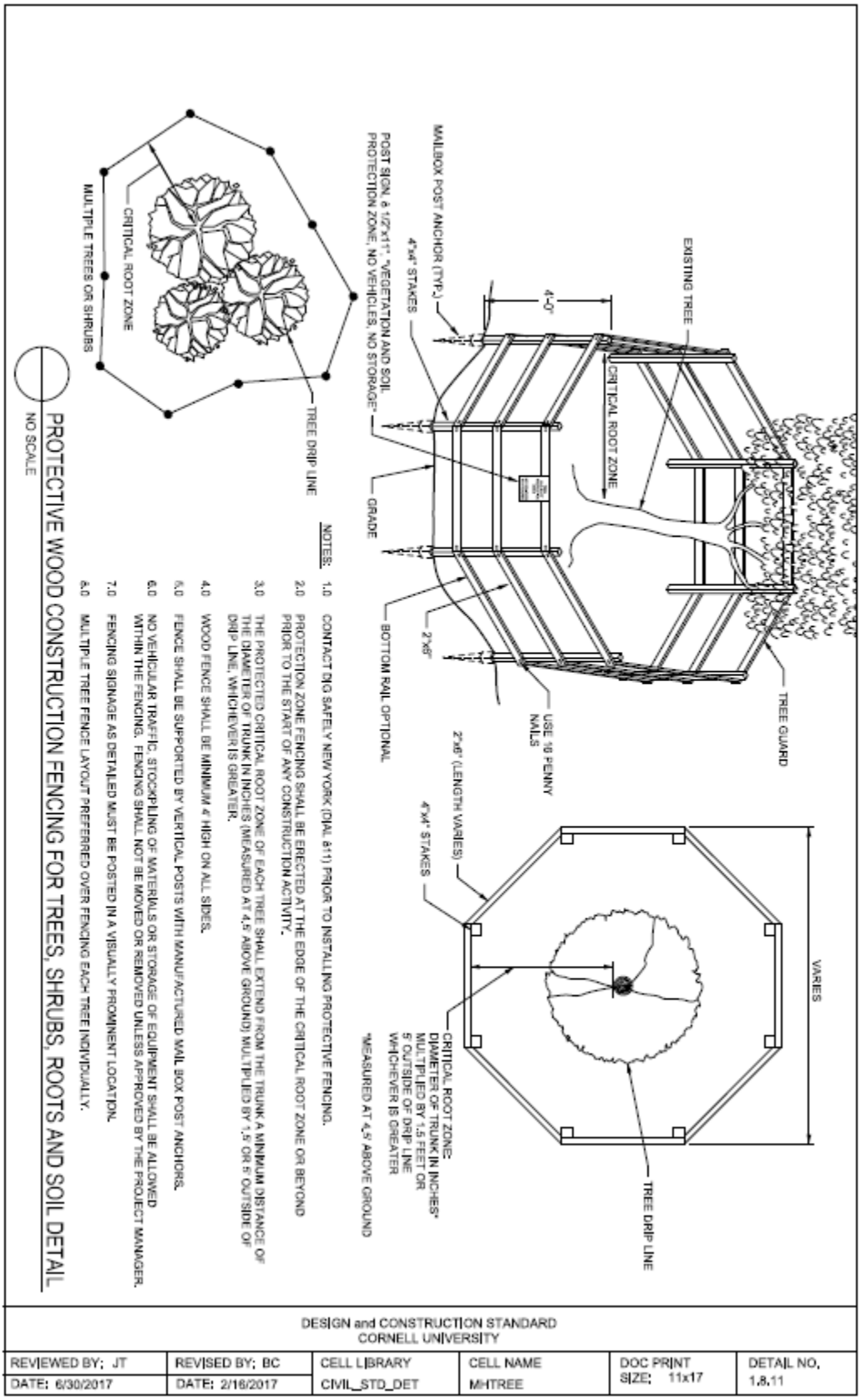
E. Carefully supervise excavating, grading and filling, and subsequent construction operations to prevent damage.

F. Replace, or suitably repair, trees, plants and lawn areas designated to remain which are damaged or destroyed due to construction operations.

G. Roots 2 inches or larger that are damaged or cut during construction are to be sawed off close to the tree side of the excavation by certified arborist.

H. During the leafing-out period in the spring, extra care should be exercised to reduce root damage such as keeping exposed roots wet, saturating soil when backfilling around roots, and backfilling as soon as possible.

I. Consult Cornell University Grounds Department for mitigation of root or tree damage.



NOTES:

1.0 CONTACT DIG SAFELY NEW YORK (DIAL 811) PRIOR TO INSTALLING PROTECTIVE FENCING.

2.0 PROTECTION ZONE FENCING SHALL BE ERECTED AT THE EDGE OF THE CRITICAL ROOT ZONE OR BEYOND PRIOR TO THE START OF ANY CONSTRUCTION ACTIVITY.

3.0 THE PROTECTED CRITICAL ROOT ZONE OF EACH TREE SHALL EXTEND FROM THE TRUNK A MINIMUM DISTANCE OF THE DIAMETER OF TRUNK IN INCHES (MEASURED AT 4.5' ABOVE GROUND) MULTIPLIED BY 1.5' OR 5' OUTSIDE OF DRIP LINE, WHICHEVER IS GREATER.

4.0 WOOD FENCE SHALL BE MINIMUM 4' HIGH ON ALL SIDES.

5.0 FENCE SHALL BE SUPPORTED BY VERTICAL POSTS WITH MANUFACTURED MAIL BOX POST ANCHORS.

6.0 NO VEHICULAR TRAFFIC, STOCKPILING OF MATERIALS OR STORAGE OF EQUIPMENT SHALL BE ALLOWED WITHIN THE FENCING. FENCING SHALL NOT BE MOVED OR REMOVED UNLESS APPROVED BY THE PROJECT MANAGER.

7.0 FENCING SIGNAGE AS DETAILED MUST BE POSTED IN A VISUALLY PROMINENT LOCATION.

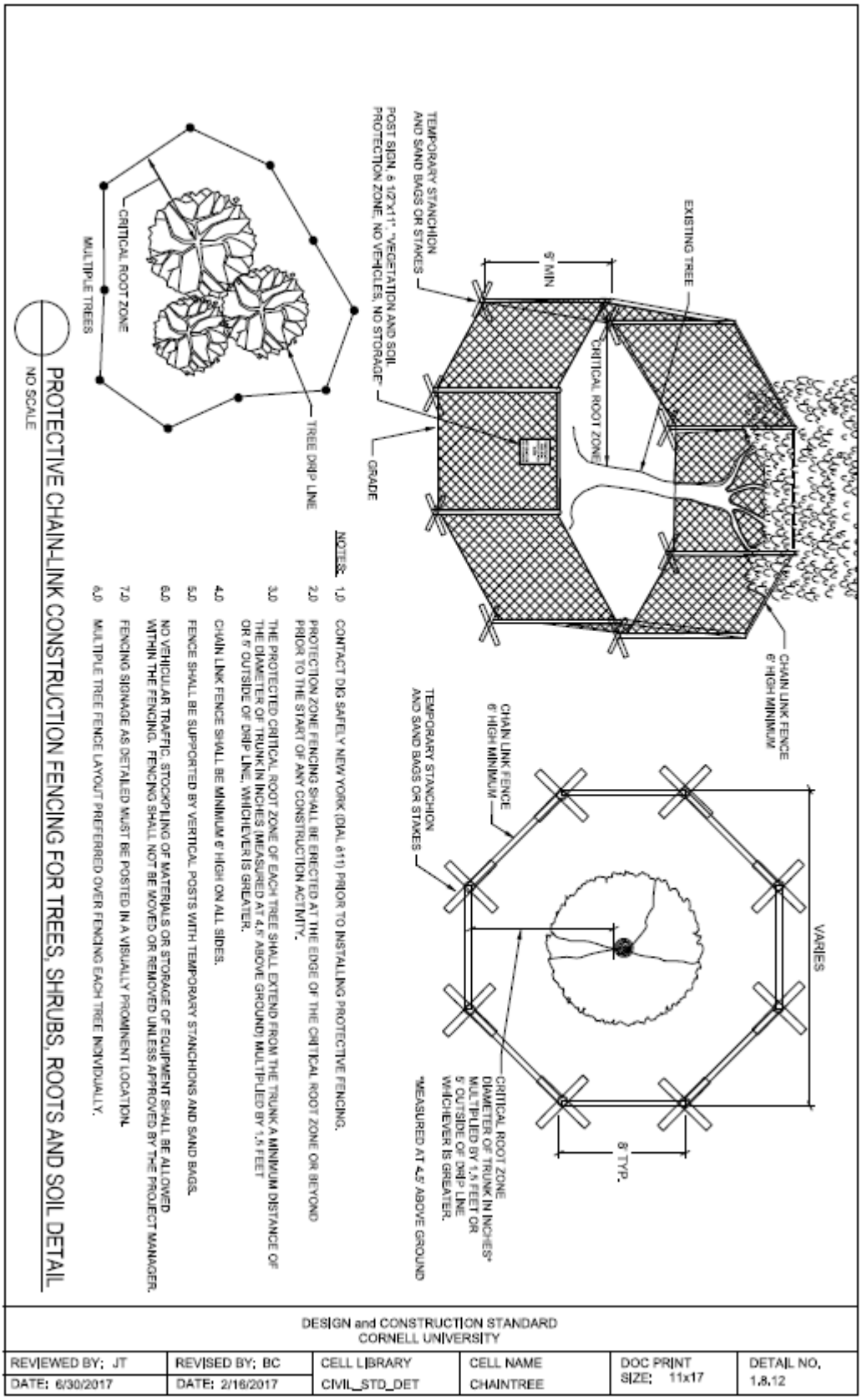
8.0 MULTIPLE TREE FENCE LAYOUT PREFERRED OVER FENCING EACH TREE INDIVIDUALLY.

NO SCALE

PROTECTIVE WOOD CONSTRUCTION FENCING FOR TREES, SHRUBS, ROOTS AND SOIL DETAIL

DESIGN and CONSTRUCTION STANDARD
CORNELL UNIVERSITY

REVIEWED BY; JT	REVISED BY; BC	CELL LIBRARY	CELL NAME	DOC PRINT SIZE; 11x17	DETAIL NO,
DATE; 6/30/2017	DATE; 2/16/2017	CIVIL_STD_DET	MHTREE		1.8.11



NOTES:

1.0 CONTACT DIG SAFELY NEW YORK (DIAL 811) PRIOR TO INSTALLING PROTECTIVE FENCING.

2.0 PROTECTION ZONE FENCING SHALL BE ERECTED AT THE EDGE OF THE CRITICAL ROOT ZONE OR BEYOND PRIOR TO THE START OF ANY CONSTRUCTION ACTIVITY.

3.0 THE PROTECTED CRITICAL ROOT ZONE OF EACH TREE SHALL EXTEND FROM THE TRUNK A MINIMUM DISTANCE OF THE DIAMETER OF TRUNK IN INCHES (MEASURED AT 4.5' ABOVE GROUND) MULTIPLIED BY 1.5 FEET OR 5' OUTSIDE OF DRIP LINE, WHICHEVER IS GREATER.

4.0 CHAIN LINK FENCE SHALL BE MINIMUM 6' HIGH ON ALL SIDES.

5.0 FENCE SHALL BE SUPPORTED BY VERTICAL POSTS WITH TEMPORARY STANCHIONS AND SAND BAGS.

6.0 NO VEHICULAR TRAFFIC, STOCKPILING OF MATERIALS OR STORAGE OF EQUIPMENT SHALL BE ALLOWED WITHIN THE FENCING. FENCING SHALL NOT BE MOVED OR REMOVED UNLESS APPROVED BY THE PROJECT MANAGER.

7.0 FENCING SIGNAGE AS DETAILED MUST BE POSTED IN A VISUALLY PROMINENT LOCATION.

8.0 MULTIPLE TREE FENCE LAYOUT PREFERRED OVER FENCING EACH TREE INDIVIDUALLY.

NO SCALE

PROTECTIVE CHAIN-LINK CONSTRUCTION FENCING FOR TREES, SHRUBS, ROOTS AND SOIL DETAIL

DESIGN and CONSTRUCTION STANDARD
CORNELL UNIVERSITY

REVIEWED BY: JT	REVISED BY: BC	CELL LIBRARY	CELL NAME	DOC PRINT SIZE: 11x17	DETAIL NO. 1.8.12
DATE: 6/30/2017	DATE: 2/16/2017	CIVIL_STD_DET	CHAINTREE		

2.9 PERSONNEL, PUBLIC AND EMPLOYEE PROTECTION

A. Provide guardrails, barricades, fences, footways, tunnels and other devices necessary to protect all personnel, employees, and the public, against hazards on, adjacent to or accessing the construction site.

1. Provide signs, warning lights, signals, flags and illumination as necessary to alert persons to hazards and to provide safe, adequate visibility in areas of hazards.

2. Closed sidewalks need to be indicated with OSHA-approved signs, as well as, proper barricades.

3. Provide flag personnel as necessary to guide vehicles, protect personnel, public and employees.

2.10 ACCESS ROADS AND PARKING AREAS

A. Provide adequate temporary roads and walks to achieve all-weather access into the site from public thoroughfares, and within and adjacent to the site as necessary to provide uninterrupted access to field offices, work and storage areas.

B. Grade and provide drainage facilities to assure runoff of rainwater and to avoid blockage of flow from adjacent areas.

C. During dry weather wet down temporary unpaved areas when necessary to prevent blowing dust.

2.11 PROJECT IDENTIFICATION AND SIGNS

A. No Contractor signs to be displayed at the project site, unless authorized by the Owner.

2.12 SECURITY

A. The Contractor shall provide security services as required to protect the interests of the Owner.

B. Locks applied to construction site gates and other access entrances shall be coordinated through the Project Manager to allow keys for emergency services.

2.13 FIELD OFFICES

A. Provide a Field office facility as required to support the Contractor's and Owner’s activity on the job site, including space, office equipment and utility hookups. Facilities shall be maintained in a condition so as not to detract from the overall Campus appearance. Installation shall be in a suitable location on the site as agreed to by the Owner.

B. Costs shall be based on either purchase price or total anticipated rental, whichever is lower. The quantity and rental rates of all Field office facilities, whether rented from third parties or owned by the Contractor, shall be subject to the prior written approval of Cornell.

C. Field Office shall include at a minimum the following:

1. Furnishings and space for small progress meetings.

2. Provide office equipment (conference table and chairs; and desks and chairs) as needed and required by Contractor.

3. Provide adequate artificial lighting, heating and cooling to provide comfortable conditions for occupants.

4. Provide data and internet connections as required. Connection and disconnection fees, as well as monthly charges for data are the responsibility of Contractor.

5. Provide janitorial services

6. Skirting shall be required on all temporary job site trailers.

7. Provide adequate parking for three (3) Cornell University employees. The field office shall accommodate private space for three (3) staff members and conference space.

D. Provide a designated break area within the project site limits to minimize interaction between construction personnel and the Campus community.

E. Within fifteen (15) days of execution of the contract, contact Cornell Facilities Inventory Office to acquire a valid facility code and address for all on-site construction trailers. Such identification is required for the Campus Police 911 Emergency Response System.

3.0 EXECUTION

3.1 PREPARATION

A. Consult with Owner, review site conditions and factors which affect construction procedures and temporary facilities, including adjacent properties and public facilities which may be affected by execution of the Work.

1. Designate the locations and extent of temporary construction, storage, and other temporary facilities and controls required for the expeditious accomplishment of the Work.

2. Allow space for use of the site by Owner and by other contractors, as required by Contract Documents.

3.2 GENERAL

A. Comply with applicable requirements specified in sections of Division 02 through 40.

B. Make work structurally, mechanically and electrically sound throughout.

C. Install work in a neat and orderly manner.

D. Maintain, clean, service and repair facilities to provide continuous usage, and to the quality specified for the original installation.

E. Relocate facilities as required by progress of construction, by storage or work requirements, and to accommodate requirements of Owner and other contractors employed at the site.

F. Keep the site, at all times during the progress of the Work, free from accumulation of waste matter or rubbish and shall confine its apparatus, materials and operations of its workers to the limits prescribed except as the latter may be extended with the approval of the Owner's Representative. Cleaning of the structure or structures must be performed daily and removal of waste matter or rubbish must be performed at least once a week.

G. Contractor shall at all times keep access road and public roads clean of mud and construction debris and maintain dust control to the satisfaction of the Owner.

3.3 REMOVAL

A. Completely remove temporary structures, materials, equipment and services:

1. When construction needs can be met by use of permanent construction.

2. At completion of the Project.

B. Repair damage caused by installation or use of temporary facilities. Clean after removal.

C. Restore existing or permanent facilities used for temporary purposes to specified, or to original condition.

1. Remove foundations and underground installations for temporary construction and utilities.

2. Grade the areas of the site affected by temporary installations to required elevations and slopes, and clean the area.

*****END OF SECTION 01 50 00*****

SECTION 01 51 00 TEMPORARY UTILITIES

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish, install and maintain temporary utilities required by all trades for construction. Remove on completion of the Work.

B. The Contractor shall provide all labor and materials for temporary connections and distribution.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code, current edition.

B. Comply with Federal, State and local codes and safety regulations and with utility company requirements.

2.0 PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.2 TEMPORARY ELECTRICITY, LIGHTING AND WATER

A. The Contractor shall have access to the Owner's water and electric power for constructing the Work. Temporary utility connections shall be made by the Contractor as close to its operations as possible as long as such connections do not over-load the capacity of the Owner's utilities or interfere with its customary utilization thereof. Utility access points shall be determined in cooperation with and acceptable to the Owner.

B. The Contractor shall be responsible for the economic use of the Owner's Water and Power. The Owner will pay for the water and power consumed in the construction of the Work as long as economical usage of these utilities is maintained. The Owner reserves the right to meter and charge for the power and water consumed if in the opinion of the Owner the usage of these utilities is not economically conducted by the Contractor. In such an event, the Owner shall give three (3) days written notice to the Contractor of its intentions to meter and charge for temporary utilities used by the Contractor.

C. All temporary power systems including wiring shall be removed by the Contractor when no longer required.

D. The minimum temporary lighting to be provided is at the rate of fifty foot candles, is to be maintained in each room and changed as required when interior walls are being erected. The required temporary lighting must be maintained for twenty-four (24) hours a day and seven (7) days a week at all stair levels and in all corridors below ground; in any and all egress; in all other spaces temporary lighting is to be maintained only during working hours. All temporary wiring and equipment shall be in conformity with the National Electric Code.

E. The minimum temporary outdoor security lighting to be provided is as follows:

1. Along the perimeter of the site fence, consisting of vandal-resistant light fixtures with HID lamps, located 150 foot center, mounted on the inside of the construction fence.

2. Lighting for temporary pedestrian paths and roadways, to provide a minimum of 0.1 foot-candle on the path of travel.

F. Three-phase temporary power circuits shall be installed as required to operate construction equipment of the various trades and to Install and test equipment such as pumps and elevators. The Contractor shall install and maintain temporary or permanent service for the permanently installed building equipment such as sump pumps, boilers, boiler controls, fans, pumps, so that such equipment may be operated when required and so ordered by the Owner's Representative for drainage or for temporary heat.

G. Except as otherwise provided in the Contract, the Contractor shall submit to the Owner or the Owner's Representative for approval a proposed schedule of all utility shutdowns and cutovers of all types which may be required in connection with the Work. Such schedule shall provide a minimum of two (2) weeks advance notice to the Owner prior to the time of the proposed shutdown and cutover. The Contractor shall be responsible for all charges relating to shutdowns.

H. Discontinuance, Changes and Removal

The Contractor shall:

1. Discontinue all temporary services required by the Contract when so directed by the Owner or the Owner's Representative. The discontinuance of any such temporary service prior to the completion of the Work shall not render the Owner liable for any additional cost entailed thereby.

2. Remove and relocate such temporary facilities as directed by the Owner or the Owner's Representative, and shall restore the Site and the Work to a condition satisfactory to the Owner.

2.3 TEMPORARY HEAT AND VENTILATION

A. The Contractor shall furnish temporary heat as may be necessary for constructing the Work.

B. The Contractor will be permitted to use the building's permanent heating system for temporary heat. Permission to use the building's permanent heating system shall in no way constitute the Owner's acceptance of that portion of the Work.

C. When using the permanent building systems for space conditioning, provide a written maintenance plan for acceptance by the Owner's Representative, prior to utilizing the equipment. Plan to address temporary filtering of air and water, sealing of open ducts, lubrication, operation outside of normal ranges, and controls/safeties. Return all equipment to its newly installed condition prior to acceptance testing.

1. If the Contractor elects to use the building's permanent heating system for temporary heat, the Contractor shall provide filters with a minimum MERV of 8 at each return-air grille in system, maintain to keep them free of dust and debris, replace if necessary and remove at end of construction and clean HVAC system as required in Section 01 77 00 – Project Closeout.

D. Any temporary system shall be removed when no longer required.

E. During heating cycles the enclosures separating the interior building areas from outside shall be maintained closed to conserve heat energy.

F. The Contractor shall provide for ventilation of all structures until physical completion of the Work and shall control such ventilation to avoid excessive moisture levels and rates of drying of construction materials, including but not limited to concrete and to plaster, and to prevent condensation on sensitive surfaces. The Contractor shall be responsible for any moisture intrusion that is detrimental to the Project.

2.4 TEMPORARY CONTRACTOR TELEPHONE SERVICE

A. Site Superintendent or their Representative shall carry a cellular telephone at all times.

B. Provide phone number to Cornell project representatives for communication during Work.

2.5 TEMPORARY SANITARY FACILITIES

A. Provide adequate toilet and washing facilities for the use of personnel and employees; locate convenient to work stations.

B. Existing plumbing facilities shall not be used by construction personnel.

C. Facilities may be portable chemical-type toilets or temporary flush toilets connected to sanitary sewer, screened for privacy.

D. Service, clean and maintain facilities and enclosures in a neat, clean and sanitary condition.

3.0 EXECUTION

3.1 REMOVAL

A. Completely remove temporary materials and equipment when their use is no longer required.

B. Clean and repair damage caused by temporary installations or use of temporary facilities.

C. Restore existing and permanent facilities used for temporary services to specified, or to original, condition.

*****END OF SECTION 01 51 00*****

SECTION 01 51 23 HEAT DURING CONSTRUCTION

1.0 GENERAL

1.1 DESCRIPTION

A. Temporary heat shall be classified according to construction schedules as follows:

1. Construction Temporary Heat - Prior to Building Enclosure

2. Stage I Temporary Heat - Building Enclosed - Permanent Heating System Not Ready for Operation

3. Stage II Temporary Heat - Building Enclosed - Permanent Heating System or Portions Thereof Operable

1.1 CONSTRUCTION HEAT - PRIOR TO BUILDING ENCLOSURE

A. Prior to the time a building or any portion thereof is enclosed, Construction Heat shall be provided by the Contractor, as required to accomplish the following:

1. To protect the Work.

2. To provide sufficient heat so that the Work can be accomplished in accordance with the Contract Documents.

3. To maintain construction schedules as required by the Contract.

B. The Contractor shall include in the bid price an amount necessary to provide Construction Heat as required prior to building enclosure and start of phased temporary heat as specified.

1.2 STAGE I HEAT - BUILDING ENCLOSED - PERMANENT HEATING SYSTEM NOT READY FOR OPERATION

A. When a building or any portion thereof is enclosed to the satisfaction of the Owner's Representative, the Contractor shall provide heat as herein specified and as directed.

B. A building or any portion thereof shall be considered enclosed when the exterior walls are erected and the roof decks are placed or poured and openings are closed sufficiently to exclude the elements. Where permanent windows, doors, ventilators, window walls and similar openings cannot be installed, the Contractor shall install temporary closures for said opening to the satisfaction of the Owner or the Owner's Representative.

C. The Contractor shall:

1. Provide Stage I Temporary Heat for all buildings and spaces in the project as necessary for the performance of the Work and to ensure compliance with all Contract Documents.

2. Furnish temporary heat, in the enclosed portions of the building starting at such times as directed by the Owner's Representative. Continuing such heat until Stage II Temporary Heat for the enclosed portion is implemented, or until otherwise directed.

3. Furnish temporary heat during different heating seasons when required by job conditions and as directed by the Owner or the Owner's Representative.

4. Furnish, operate and pay for a sufficient number of heating units and fuel to maintain heat between 45˚F and 55˚F, twenty-four (24) hours a day in all enclosed portions of the building which are to be heated. Provide higher temperatures if required to allow certain finish work to proceed or to protect the Work.

5. Vent the heating units to the outside unless electrical heating units are provided.

6. Provide temporary CO (carbon monoxide) monitors unless electrical heating units are provided.

7. Provide heating units which comply with applicable laws, rules and regulations.

8. Move, relocate or adjust the heating units as required to maintain the specified temperature and to protect the Work.

9. Provide all labor and material necessary to properly maintain and operate the temporary heat.

10. Maintain proper ventilation in the building to control humidity within acceptable limits as described in the technical specifications.

1.3 STAGE II TEMPORARY HEAT - BUILDING ENCLOSED – PERMANENT HEATING SYSTEM, OR PORTIONS THEREOF, OPERABLE

A. The Contractor shall:

1. Before the expiration of the time specified for Stage I Temporary Heat, have progressed the Work so that the permanent heating system may be used to supply temporary heat under this Stage II.

2. Provide Stage II Temporary Heat for all buildings and spaces in the project as necessary for the performance of the Work and to ensure compliance with all Contract Documents.

3. Furnish temporary heat, using the permanent heating system, starting when directed by the Owner's Representative. Continue such heat in all spaces for the days and manner as specified in the Contract, until Stage III heat is implemented or until otherwise directed.

4. Furnish Stage II Temporary Heat during different heating seasons when required by job conditions and as directed by the Owner's Representative.

5. Complete the Work to place the permanent heating system in satisfactory operating condition.

6. Make all necessary arrangements for and pay all costs in connection with providing the personnel for maintaining and operating the heating system used for temporary heat.

7. Provide ventilation in the building to maintain humidity to acceptable limits.

8. Coordinate the operations of others involved in the Work to insure that temporary heat is supplied as required by the Contract.

9. Furnish and pay for all fuel required to furnish heat as required for Stage II Temporary Heat.

10. Thoroughly clean, test and otherwise prepare the permanent heating system for use for Stage II Temporary Heat.

11. Provide sufficient heat to produce a temperature of not less than 65˚F, or more than 78˚F unless otherwise specified in the Contract. Provide alternate temperature range if required for certain finish work to proceed or to protect the Work.

12. Provide approved temporary protective covers for the heating equipment which may be damaged by performance of the Work of the Contract.

13. Furnish and Install filters, other than permanent filters, to maintain the air supply systems and equipment used for temporary heat free of dust and debris.

14. Clean all equipment before the permanent heating system is turned over to the Owner.

15. Service and leave all permanent equipment used in connection with temporary heat in perfect operating condition.

16. Furnish and install permanent filters as required by the Work.

17. Remove all temporary equipment provided for temporary heating services which is not part of the permanent system when so directed by the Owner or the Owner's Representative.

18. A hydronic or air heating system other than the permanent system may be used under the following conditions:

    a. It is not electric (except for fan motor drives and ignition).

    b. It is approved by the Owner or the Owner's Representative.

    c. It provides the same degree of heat.

    d. It provides the same quality of heat.

    e. It provides the same humidity.

    f. All spaces are heated.

g. It does not interfere in any way with the progress of the Work.

h. It is completely removed when Stage II Temporary Heat is no longer required.

i. All cost of installation, operation and removal is borne by the Contractor.

B. The Contractor shall progress the Work so that prior to the end of the period of time specified for Stage II Temporary Heat all work will be sufficiently completed to use Stage II heat as specified.

1.4 THERMOMETERS - RECORDERS - SUPPLIES

A. The Contractor shall:

1. Furnish, place and maintain one, eight-inch or larger, thermometer for each 4,000 sq. ft. of floor area.

2. Furnish, maintain, install and operate where directed (and relocate as directed): two (2) portable seven-day, self-contained recording thermometers complete with all accessories to record the air temperature and humidity within the building.

3. Furnish all necessary supplies such as charts, ink, etc., for each recording thermometer. Charts shall be seven-day charts arranged for a temperature range of 30˚F to 120˚F. The recording thermometers and all supplies and instruments must be delivered to the Owner's Representative prior to the start of any temporary heat and will become the property of the Owner.

B. The Contractor shall make all charts available to the Owner’s Representative for inspection at all times, and when no longer needed, shall become the property of Owner.

1.5 RESPONSIBILITY

A. The Contractor shall include in the bid the cost of the temporary heat.

B. The Contractor shall be responsible for the Work under the Contract damaged due to frost or freezing during all phases of the Project.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 51 23*****

SECTION 01 57 13 SOIL EROSION AND SEDIMENT CONTROL

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall be responsible for preparing and implementing an Erosion and Sediment Control Plan.

B. This Section describes minimum standards for the prevention and control of erosion during the construction process and may not be sufficient for all sites. The Contractor shall remain responsible for the means and methods of preventing erosion and may be required to employ additional means and methods as required to prevent violations of local, state, or federal standards.

C. Contractor shall be responsible for regulatory fines and/or delays resulting from Contractor's failure to adhere to the plan or correct deficiencies identified during inspections.

D. On certain sites, a Storm Water Pollution Prevention Plan may also be required which may include additional or more specific requirements. The requirement for a Storm Water Pollution Prevention Plan will be indicated by inclusion of Section 01 57 23 Storm Water Pollution Prevention Plan, or alternative equivalent Section, in the Contract Documents.

1.2 SUBMITTALS

A. Submit an Erosion and Sediment Control Plan, as specified herein.

B. Refer to Section 01 33 00 – Submittal Procedures.

1.3 PLAN AND IMPLEMENTATION GENERAL REQUIREMENTS

A. Plan shall comply with design specifications in the New York Guidelines for Urban Erosion and Sediment Control, NYS Stormwater Management Design Manual, NYSDEC Technical and Operational Guidance Series, local storm water codes, good engineering practices, and this Section.

B. Erosion and Sediment Control Plan shall be reviewed and approved by the Environment, Health and Safety Office, and implemented prior to any site work. Contact information for EHS can be found at: https://ehs.cornell.edu/about-us/contact-us

C. Maintain Erosion and Sediment Control measures throughout the course of site construction activities until vegetative growth is established to the Owner's satisfaction.

D. At conclusion of the Project, remove all remaining temporary erosion control structures and properly dispose of accumulated sediment on-site in areas approved by the Owner.

1.4 PERFORMANCE STANDARDS

A. At no time shall construction operations or any related disturbance of the site result in the impairment of local waterways. "Impairment" is defined by regulations as including, but not limited to, the following:

1. The release of water into receiving waters that causes a substantial visible contrast to natural conditions; or

2. The deposition of significant sediment into such waters.

B. Such deficiencies shall be corrected immediately by the Contractor to prevent further impairment.

C. In addition, and without notice to the Contractor, the Owner shall also have the right, based on the Owner's independent assessment, to stop work or engage other contractor(s) to construct or correct such work as may be necessary to prevent the impairment of waterways, and to charge all costs related to such corrective or additional actions against the Contract.

D. Acceptance of an Erosion and Sediment Control plan shall not in any way imply that the plan will be adequate in preventing impairment of waters, or that maintenance and modification will not be necessary. Rather, acceptance of the plan authorizes the Contractor to begin installation of the control measures under the assumption the appropriate maintenance and modification will be required throughout the life of the project to meet the project requirements.

E. The Contractor's responsibilities under this Section shall end upon final completion and payment of the Work of the entire Contract.

1.5 EROSION AND SEDIMENT CONTROL PLAN COMPONENTS

A. The Erosion and Sediment Control Plan submitted shall specifically address project measures, features, and areas critical to proper site erosion and sediment control. The Plan shall specifically include, but are not limited to, the following:

1. Site Map, to scale;

2. Measures to prevent stormwater from running onto the disturbed areas of the site;

3. Inlet protection for storm sewers and catch basins;

4. Measures to be used for dewatering; and

5. Measures to be used for soil stabilization, runoff control, and sediment control, including specific measures for the following:

a. Site entrance stabilization

b. Staging areas

c. Material and soil stock piles

d. Concrete curing operations

e. Disturbed areas of the site

In addition to the requirements included in these specifications, specific erosion control measures shown on the Contract Drawings, if any, shall also be required.

B. All features shall be designed and installed in accordance with the references included in Paragraph 1.3 – Plan and Implementation General Requirements of this Section.

C. Keep access roads and public roads clear of mud and construction debris at all times. Maintain dust control measures throughout construction.

1.6 INSPECTIONS

A. At the sole discretion of the Owner, inspections may be performed by a third party or on-staff representative of the Owner.

1. The Owner may inspect the site at any time, without prior notification, for compliance with the Erosion and Sediment Control Plan and applicable local, state and federal regulations. Any instances of non-compliances or failure to meet the performance standards found must be resolved within 24 hours, with more immediate responses as required to mitigate active erosion during storm events or similar instances.

2. Modify the Erosion and Sediment Control Plan as necessary, to provide full compliance with the performance standards.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 57 13*****

SECTION 01 57 23 STORMWATER POLLUTION AND PREVENTION PLAN

1.0 GENERAL

1.1 DESCRIPTION

A. A Storm Water Pollution Prevention Plan (SWPPP) for construction activities at the project site has been appended to these Contract Documents.

B. The Contractor shall review the SWPPP during bidding. The signature of the Contractor and all Subcontractors on that plan is required as an element of its implementation.

C. Implement the SWPPP for this site and ensure all work by all Contractors and Subcontractors complies with the plan.

D. The SWPPP incorporates provisions for soil erosion and sediment control, as specified in Section 01 57 13. However, the Contractor is still required to provide a site-specific Soil Erosion and Sediment Control Plan, as specified in Section 01 57 13, to verify understanding, ensure compliance, and incorporate project phasing requirements.

1.2 PERFORMANCE STANDARDS

A. Performance Standards are referenced in the SWPPP.

B. Any failure to meet these standards shall be corrected immediately by the Contractor to prevent further impairment. Contractor shall be at all times liable for any enforcement or legal action resulting from such impairment.

C. In addition, and without notice to the Contractor, the Owner shall also have the right, based on the Owner's independent assessment, to stop work or engage other contractor(s) to construct or correct such work as may be necessary to prevent such impairment, and to charge all costs related to such corrective or additional actions against the Contract.

1.3 INSPECTIONS

Inspections will be performed by the Owner or a third party hired by the Owner in accordance with Part III.4 of the General Permit.

A. Contractor shall schedule a kick-off meeting with Owner and Owner's Inspector at least seven days prior to initial installation of erosion and sediment control measures.

B. Issues addressed on inspection reports submitted to the Contractor shall be addressed immediately. All non-compliances must be resolved within 24 hours.

C. Based on the results of the inspection, the SWPPP shall be modified by the Contractor as necessary, in accordance with Part III.D.4.b of the General Permit.

D. Owner's storm water inspector shall participate in the progress meetings, as necessary.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 57 23*****

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STORMWATER POLLUTION PREVENTION PLAN

CORNELL UNIVERSITY
LIVESTOCK PAVILION SURGE SPACE RENOVATIONS
PHASE ONE
City of Ithaca, NY

STATE CONTRACT #: D014457

October 15, 2024
****

OWNER:

Cornell University
48 Judd Falls Road
Ithaca, NY 14850

Contractor:

To be determined

PREPARED BY:

Studio A Landscape Architecture + Engineering, D.P.C.
74 Warren Street, Ste. 1
Saratoga Springs, NY 12866

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APPENDCIES

A PROJECT LOCATION MAP
B USDA SOIL SURVEY
C EROSION CONTROL PLAN

DESCRIPTION OF EXISTING SITE

The project site consists of one parcel, Tax Map No 503089-67.-1-13.2. The project site consists of 30.95± acres that are located on Thurston Avenue in the City of Ithaca, Tompkins County, NY.

The 15,400 GSF Livestock Pavilion was constructed in 1913 and is located on the campus of Cornell University. It is located immediately to the east of Wing Hall. Judd Falls Road borders the east, Tower Road borders the north, Wing Drive borders the west and Campus Road borders the south. Uses surrounding the project perimeters are all campus related.

Erosion and sediment control measures will be implemented and maintained for the duration of the project to prevent silt from discharging into existing drainage ways. Details regarding existing site conditions, proposed development, and erosion and sediment control practices are provided in the following sections.

DESCRIPTION OF EXISTING SOILS

The United States Department of Agriculture (USDA) Soil Survey obtained from the Natural Resource Conservation Service website indicates the surficial soil types on within the proposed project area to be Made Land (Mc).

The Mc series is identified by the USDA as hydrologic soil group (HSG) "B." These soils exhibit a somewhat excessively drained rate. This soil typically consists of a channery loam transitioning to a very gravelly sandy loam deeper on the soil profile.

DESCRIPTION OF PROPOSED DEVELOPMENT

The project is to be completed in two phases. Phase one includes the site utilities, abatement/demolition, and procurement of long-lead items. Phase two includes renovation of the interior of the building.

Phase one site improvements include the removal and installation of underground utilities that service the building's proposed use. These utilities include mechanical, electrical, fire protection, domestic water service, stormwater, and sanitary lines. The proposed hardscape and landscape design will restore areas that are disturbed for the underground utility installation work. Selective hardscape will be demolished and replaced due to the installation of utility lines.

This total area encompasses approximately 5,350+/-SF of disturbance.

CONSTRUCTION PHASING

The proposed phase one site improvements will be completed in one phase and construction activities are anticipated to commence in January of 2025. Installation of silt soxx shall be in accordance with the construction drawings prior to any disturbance to the existing ground surface.

POLLUTION PREVENTION MEASURES

Any litter on site, including construction debris, will be picked up each day and disposed of into solid waste containers. The contractor shall provide an approved secondary containment system for all fuel and petroleum temporarily stored on site. All vehicles on site will be monitored for leaks and receive regular preventative maintenance to reduce the chance of mechanical fluid leakage. During the placement of concrete for the walkway, measures will be taken to ensure that fresh concrete does not enter any defined drainage paths and a concrete washout area will be provided by the contractor in accordance with the construction drawings.

SEDIMENTATION AND EROSION CONTROL

Prior to commencing any land clearing, silt soxx will be installed in accordance with the construction drawings to collect silt from construction runoff. The contractor is required to maintain the silt soxx and other applicable erosion and sediment control practices throughout the construction period.

All exposed surfaces not covered with paving, structures, and similar finished surfaces will be covered with topsoil and seeded to establish a turf covering or will be landscaped and mulched. The areas receiving seed will be mulched to minimize erosion. Silt soxx shall be installed downslope of the newly seeded areas.

All erosion control measures shall be maintained and replaced, as required, during the course of construction until a well-established growth of turf is established. Silt soxx shall be replaced as required during the course of construction until a well-established vegetative cover is established.

Erosion and sediment control measures shall be inspected daily by a trained contractor as defined in Appendix A of the New York State Department of Environmental Conservation SPDES General Permit for Stormwater Discharges from Construction Activity Permit No. GP-0-20-001. Construction inspections shall be conducted in accordance with Part IV.C of GP-0-20-001.

RETENTION OF RECORDS

The Owner shall maintain a copy of this Storm Water Pollution Prevention Plan (SWPPP) at the project site. In addition, the contractor shall maintain a site logbook which will contain all storm water and erosion control inspection reports to be prepared by the trained contractor. A current copy of the construction drawings shall also be kept in the logbook with comments that may have been added by the trained contractor, owner's representative or design professional.

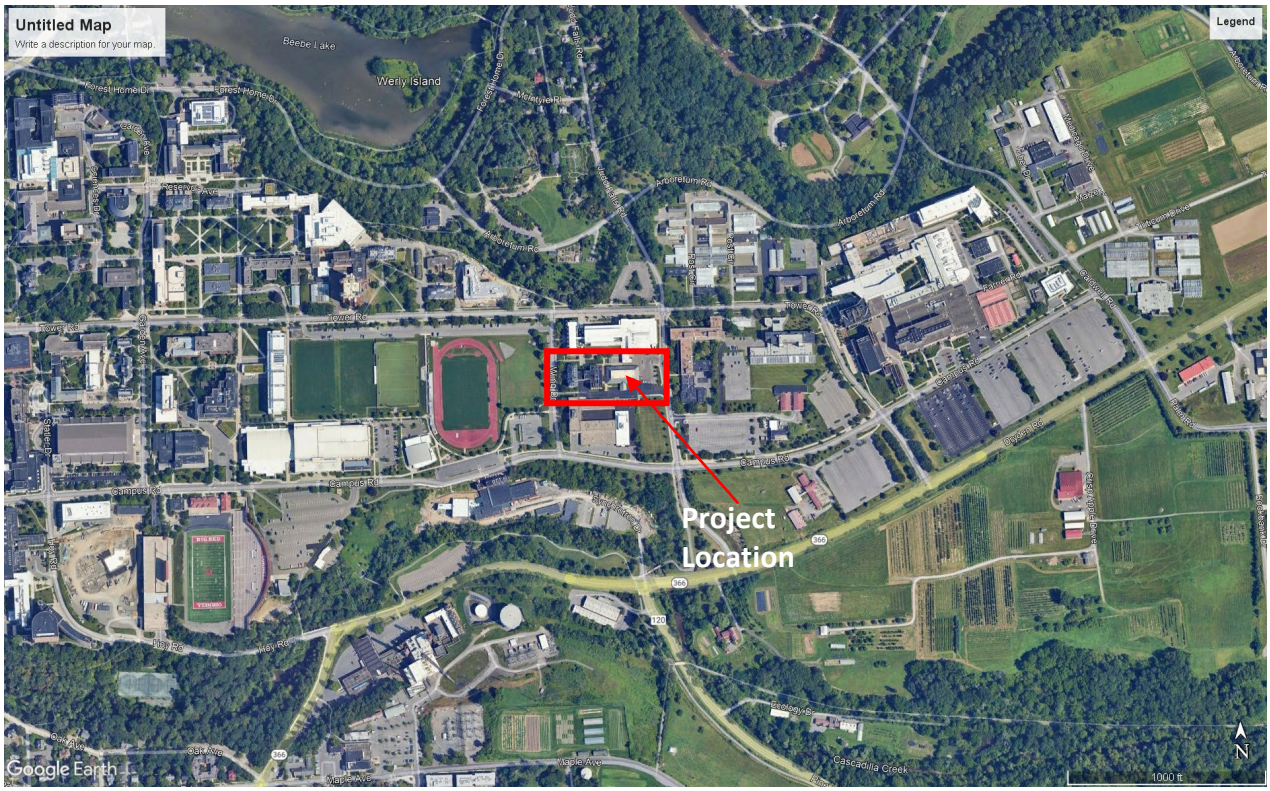
SWPPP Report Prepared by:



Matthew E. Huntington, PE
President
For
Studio A | Landscape Architecture + Engineering, D

APPENDIX A

Project Location Map


Untitled Map
Write a description for your map.
Legend
Beebe Lake
Werly Island
Project Location
Google Earth
1000 ft
N

APPENDIX B

USDA SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Tompkins County, New York



October 15, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Tompkins County, New York
Survey Area Data: Version 20, Aug 29, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2020—Oct 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ab	Alluvial land	0.1	0.2%
BtF	Bath, Valois, and Lansing soils, 35 to 60 percent slopes	0.1	0.6%
HsB	Hudson silty clay loam, 2 to 6 percent slopes	0.4	1.5%
HsC3	Hudson silty clay loam, 6 to 12 percent slopes, eroded	0.6	2.5%
Mc	Made land	21.4	90.3%
RkA	Rhinebeck silt loam, 0 to 2 percent slopes	1.1	4.8%
Totals for Area of Interest		**23.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Tompkins County, New York

Ab—Alluvial land

Map Unit Setting

National map unit symbol: 9xkp
Elevation: 100 to 3,000 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents and similar soils: 40 percent
Udifluvents and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium with highly variable texture

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 72 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F140XY015NY - Wet Low Floodplain
Hydric soil rating: Yes

Description of Udifluvents

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit

Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium with a wide range of texture

Typical profile

H1 - 0 to 4 inches: gravelly loam
H2 - 4 to 72 inches: very gravelly sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 24 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A
Ecological site: F140XY014NY - Low Floodplain
Hydric soil rating: No

Minor Components

Genesee (hamlin)

Percent of map unit: 5 percent
Hydric soil rating: No

Eel (teel)

Percent of map unit: 5 percent
Hydric soil rating: No

Wayland

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Fresh water marsh

Percent of map unit: 5 percent
Landform: Marshes
Hydric soil rating: Yes

Sloan

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

BtF—Bath, Valois, and Lansing soils, 35 to 60 percent slopes

Map Unit Setting

National map unit symbol: 2v32j
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Bath and similar soils: 30 percent
Valois and similar soils: 25 percent
Lansing and similar soils: 20 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bath

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till derived mainly from gray and brown siltstone, sandstone, and shale

Typical profile

A - 0 to 4 inches: channery silt loam
Bw1 - 4 to 15 inches: channery silt loam
Bw2 - 15 to 25 inches: channery loam
E - 25 to 29 inches: channery loam
Bx - 29 to 52 inches: very channery silt loam
C - 52 to 72 inches: very channery silt loam

Properties and qualities

Slope: 35 to 60 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 26 to 38 inches to fragipan
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F140XY030NY - Well Drained Dense Till
Hydric soil rating: No

Description of Valois

Setting

Landform: End moraines, lateral moraines, valley sides
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from sandstone, siltstone, and shale

Typical profile

H1 - 0 to 2 inches: gravelly silt loam
H2 - 2 to 32 inches: gravelly silt loam
H3 - 32 to 49 inches: gravelly silt loam
H4 - 49 to 60 inches: gravelly silt loam

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 24 to 36 inches to fragipan
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Description of Lansing

Setting

Landform: Hills, drumlinoid ridges
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile

A - 0 to 8 inches: gravelly silt loam
E - 8 to 13 inches: gravelly silt loam
Bt/E - 13 to 21 inches: gravelly silt loam
Bt1 - 21 to 28 inches: gravelly silt loam

Bt2 - 28 to 39 inches: gravelly silt loam
C - 39 to 79 inches: gravelly loam

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F101XY012NY - Till Upland, F140XY027NY - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Cayuga

Percent of map unit: 5 percent
Landform: Till plains, lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Honeoye

Percent of map unit: 5 percent
Landform: Till plains, drumlins
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Darien

Percent of map unit: 5 percent
Landform: Till plains, hills, drumlinoid ridges
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Lordstown, very stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Mountainflank, nose slope, free face, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Mardin

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

HsB—Hudson silty clay loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 9xm6
Elevation: 300 to 1,800 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hudson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hudson

Setting

Landform: Lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 12 inches: silty clay loam
H2 - 12 to 36 inches: silty clay loam
H3 - 36 to 60 inches: silt loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: F101XY009NY - Moist Lake Plain
Hydric soil rating: No

Minor Components

Cayuga

Percent of map unit: 5 percent
Hydric soil rating: No

Collamer

Percent of map unit: 5 percent
Hydric soil rating: No

Rhinebeck

Percent of map unit: 5 percent
Hydric soil rating: No

Niagara

Percent of map unit: 5 percent
Hydric soil rating: No

HsC3—Hudson silty clay loam, 6 to 12 percent slopes, eroded

Map Unit Setting

National map unit symbol: 9xm7
Elevation: 300 to 1,800 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Hudson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hudson

Setting

Landform: Lake plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 12 inches: silty clay loam
H2 - 12 to 36 inches: silty clay loam
H3 - 36 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Ecological site: F101XY009NY - Moist Lake Plain
Hydric soil rating: No

Minor Components

Cayuga

Percent of map unit: 5 percent
Hydric soil rating: No

Collamer

Percent of map unit: 5 percent
Hydric soil rating: No

Rhinebeck

Percent of map unit: 5 percent
Hydric soil rating: No

Ovid

Percent of map unit: 5 percent
Hydric soil rating: No

Mc—Made land

Map Unit Setting

National map unit symbol: 9xnd
Elevation: 160 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Typical profile

H1 - 0 to 4 inches: channery loam
H2 - 4 to 70 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Phelps

Percent of map unit: 5 percent
Hydric soil rating: No

Lamson

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Alden
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Bath
Percent of map unit: 5 percent
Hydric soil rating: No

Erie
Percent of map unit: 5 percent
Hydric soil rating: No

Conesus
Percent of map unit: 5 percent
Hydric soil rating: No

RkA—Rhinebeck silt loam, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 9xp0
Elevation: 80 to 1,000 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Prime farmland if drained

Map Unit Composition
Rhinebeck and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rhinebeck

Setting
Landform: Lake plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile
H1 - 0 to 12 inches: silt loam
H2 - 12 to 23 inches: silty clay loam
H3 - 23 to 60 inches: silty clay loam

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F140XY018NY - Moist Lake Plain
Hydric soil rating: No

Minor Components

Niagara

Percent of map unit: 5 percent
Hydric soil rating: No

Canandaigua

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Ovid

Percent of map unit: 5 percent
Hydric soil rating: No

Madalin

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Hudson

Percent of map unit: 5 percent
Hydric soil rating: No

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APPENDIX C

EROSION CONTROL PLAN

EROSION & SEDIMENT CONTROL NOTES:

1. ALL EXPOSED SOIL DISTURBANCE SHALL BE IN ACCORDANCE WITH THE NYS DEC REQUIREMENTS. ANY EXPOSED SOIL SHALL BE PROPERLY STABILIZED WITH EITHER PERMANENT SEED AND MULCH IF SOIL DISTURBANCE IS COMPLETED OR TEMPORARILY SEEDED AND MULCHED IF IT WILL BE MORE THAN 14 DAYS BEFORE ADDITIONAL SOIL DISTURBANCE WILL OCCUR. EXPOSED SOIL SHALL RECEIVE TEMPORARY OR PERMANENT SEED AND MULCH WITHIN 14 DAYS OF DISTURBANCE.
2. THE CONTRACTOR SHALL LIMIT THE AREA OF CLEARING AND GRUBBING, EXCAVATION, BORROW, AND EMBANKMENT OPERATIONS IN PROGRESS, COMMENSURATE WITH THEIR CAPABILITY AND PROGRESS IN KEEPING THE FINISH GRADING AND MULCHING, SEEDING AND OTHER TEMPORARY AND/OR PERMANENT CONTROL MEASURES IN ACCORDANCE WITH THESE PLANS.
3. THE CONTRACTOR SHALL DESIGNATE TO THE OWNER'S REPRESENTATIVE A QUALIFIED EROSION AND SEDIMENT CONTROL SUPERVISOR WITH ADEQUATE TRAINING, EXPERIENCE, AND AUTHORITY TO IMPLEMENT AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES AS PER THE NYS DEC REQUIREMENTS.
4. CONSTRUCTION IS TO PROCEED IN ACCORDANCE WITH THE CONSTRUCTION PHASING SCHEDULE SUPPLIED BY THE CONTRACTOR OR SHOWN ON THE PLANS. GRASSES SHALL BE ESTABLISHED ON ALL DISTURBED AREAS AS SOON AS POSSIBLE. FOR TIME FRAMES OUTSIDE THE GROWING SEASON, OTHER METHODS OF SOIL STABILIZATION (SUCH AS THE USE OF JUTE MESH EXCELSIOR MATTING) WILL BE USED UNTIL SUCH A TIME AS GRASS CAN BE ESTABLISHED.
5. ALL APPLICABLE EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE IN PLACE PRIOR TO ANY SITE DISTURBANCE. THIS INCLUDES GRADING OPERATIONS, UTILITY OR STRUCTURE INSTALL.
6. SOIL EROSION AND SEDIMENT CONTROL PRACTICES ON THIS PLAN SHALL BE CONSTRUCTED IN ACCORDANCE WITH NYS DEC REQUIREMENTS.
7. APPLICABLE EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE LEFT IN PLACE UNTIL THE CONTRIBUTING DRAINAGE AREA SERVED IS STABILIZED.
8. THE CONTRACTOR SHALL PERFORM ALL WORK, FURNISH ALL MATERIALS AND INSTALL ALL MEASURES REQUIRED TO REASONABLY CONTROL SOIL EROSION RESULTING FROM CONSTRUCTION OPERATIONS AND PREVENT EXCESSIVE FLOW OF SEDIMENT FROM THE CONSTRUCTION SITE.
9. THE SITE SHALL AT ALL TIMES BE GRADED AND MAINTAINED SUCH THAT ALL STORMWATER RUNOFF IS DIVERTED TO SOIL EROSION AND SEDIMENT CONTROL FACILITIES.
10. ALL SEDIMENTATION STRUCTURES WILL BE INSPECTED AND MAINTAINED AFTER EVERY STORM EVENT.
11. THE CONTRACTORS ATTENTION IS DIRECTED TO THE FACT THAT THROUGHOUT THE DURATION OF THE PROJECT IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO PROTECT ALL WATER COURSES FROM WATER BORNE SEDIMENT OR POLLUTANTS ORIGINATING FROM ANY WORK DONE ON, OR IN SUPPORT OF THIS PROJECT.
12. ALL NECESSARY PRECAUTIONS SHALL BE TAKEN TO PREVENT CONTAMINATION OF WATERBODIES BY SILT, SEDIMENT, FUELS, SOLVENTS, LUBRICANTS, EPOXY COATINGS, CONCRETE LEACHATE, OR ANY OTHER POLLUTANT ASSOCIATED WITH CONSTRUCTION AND CONSTRUCTION PROCEDURES.



LEGEND

SILT SOXX

MATERIAL STOCKPILE AREA

GRAPHIC SCALE

20 0 10 20 40

1 INCH = 20 FEET

Architectural Resources
505 Franklin St
Buffalo, New York 14202
303 West 13th Street
New York, New York 10014
716-883-5566 716-883-5569 fax

Jacobs
1 Penn Plaza, 10th floor, Suite 1005
New York, NY 10119
PHONE: 646-908-6550
FAX: 646-908-6551

M/E Engineering
300 Trolley Boulevard
Rochester, NY 14606
PHONE: 585-288-5590
FAX: 585-288-0233

Spring Line Design
73 Troy Road
East Greenbush, NY 12061
PHONE: 518-487-4755
FAX: 518-670-0122

Studio A
74 Warren Street, Suite 1
Saratoga Springs, NY 12866
PHONE: 518-450-4030

Simpson Gumpertz & Heger Inc.
800 Boyston Street, Suite 2320
Boston, MA 02199
PHONE: 617-963-5400
FAX: 617-963-5401

Watts Architecture and Engineering
95 Perry Street, Suite 300
Buffalo, NY 14203
PHONE: 716-206-5100
FAX: 716-206-5199

RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE PHASE 1

CORNELL UNIVERSITY
48 Judd Falls Road
Ithaca, NY 14850

SEAL

STATE OF NEW YORK · MATTHEW E. HUNTINGTON · 081080 · LICENSED PROFESSIONAL ENGINEER

N

Bid Documents

Date 10/08/2024

REVISIONS

NO.	DESCRIPTION	DATE

A|r JOB NO.: 564.23
CLIENT NO.: 12932-2457
DRAWN BY: STA
SHEET NO:

SECTION 01 66 00 STORAGE AND PROTECTION

1.0 GENERAL

1.1 DESCRIPTION

A. Receive, pile, store and handle all materials, equipment and other items incorporated or to be incorporated in the Work, including items furnished by the Owner in a careful and prudent manner and shall protect them against loss or damage from every source.

B. Obscure from public view, in a manner acceptable to the Owner, staging and storage areas.

1.2 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions; using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction space.

C. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

D. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installation.

E. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.

F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

1.3 ON-SITE STORAGE

A. Materials stored on the Site shall be neatly piled and protected, and shall be stored in a neat and orderly manner in locations that shall not interfere with the progress of the Work or with the daily functioning of the Institution.

B. Materials subject to weather damage shall be protected against the weather by floored weatherproof temporary storage sheds.

C. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

D. Storage piles and sheds shall be located within the area designated as the Staging Area. The Contractor shall work to ensure that the condition of the staging area has no negative impact on the Campus, visually or otherwise; and that outside of that area. The Contractor has no impact at all on the Campus.

E. Materials stored within the building shall be distributed in such a manner as to avoid overloading of the structural frame, and never shall be concentrated in such a manner as to exceed the equivalent of 50 pounds per square foot uniformly distributed loading. Stored materials shall be moved if they interfere with the progress of the Work.

F. Should it become necessary during the course of the Work to move stored materials or equipment, the Contractor, at the direction of the Owner or the Owner's Representative, shall move such materials or equipment.

1.4 CAMPUS SITE / BOOKBANK DRIVE STORAGE

A. All property including construction materials and equipment stored at the Bookbank Drive or other Campus site, shall be stored at the Contractor's sole risk. The Contractor is solely responsible for repair or replacement of property due to any cause of loss. Due to work at the Bookbank Drive lot, staging space is limited and not guaranteed to be provided. If staging space is needed, a request should be submitted to the Project Manager.

B. The Contractor agrees to hold Cornell harmless from any accident or injury occurring at Bookbank Drive storage or other assigned Campus site associated with the Contractor's storage.

C. The Contractor understands that Cornell makes "no" warranty regarding any security at the Bookbank Drive or other assigned Campus site.

D. The Contractor agrees that it is solely responsible for any cleanup of any site contamination caused by the Contractor's storage or storage operations and the Contractor agrees to pay for cleanup of any contamination and restore the site back to the same condition it was found.

E. It shall be assumed that the Contractor is responsible for site contamination unless the Contractor has reported condition prior to moving storage materials and equipment onto the site. Each Contractor shall be responsible for their own general area whether defined formally or not but in cases where pollutants have traveled or are found in the public areas used by all contractors, the Contractor agrees as follows:

1. If it cannot be determined who is responsible for site contamination after an investigation, all contractors who could be responsible based upon location of the incident agree to share the expense of cleanup equally.

F. No storage of hazardous materials or environmental contaminants is permitted at the Bookbank Drive or any Campus site. All barrels must have labels affixed identifying contents.

G. The Contractor will be responsible for securing and maintaining any Campus site area designated to them. All contractor trailers or storage containers located on Cornell Campus Property will need to file for a building permit with the Town of Ithaca. If the trailer/container is there longer than 180 days, the trailer/container will need to meet the Building Code requirements of a permanent structure. The trailer/container will need a means of egress that can be operated from the inside and a fire extinguisher. The contractor will also need to file for a demolition permit when the trailer/container is removed

H. Unoccupied storage containers not within the project fence shall be labeled in the Cornell standard.

1.5 PROTECTION

A. The Contractor shall provide security personnel and adopt other security measures as may be necessary to adequately protect materials and equipment stored at the site. The Contractor shall be obligated to replace or pay for all materials and equipment including items furnished by the Owner which have been damaged or stolen prior to completion of the Work.

B. Protection of Utilities

1. If during the course of the Project, it is necessary to work adjacent to existing utilities, pipelines, structures and equipment, the Contractor shall take all necessary precautions to protect existing facilities from damage.

2. Locations of utilities as shown on the Contract Documents are approximate only. The Contractor shall excavate or otherwise locate to verify existing utilities in advance of its operation.

C. Protective Covering

1. All finished surfaces shall be protected by the Contractor as follows:

a. Door and windowsills and the jambs and soffits of openings used as passageways or through which material is handled, shall be cased and protected adequately against possible damage resulting from the conduct of the work of all trades.

b. All surfaces shall be clean and not marred upon delivery of the building to the Owner. The Contractor shall, without extra compensation, replace all blocks, gypsum board, plaster, paint, tile, and all other surfaces, whether or not protected, which are damaged, and shall refinish (including painting as specified) to satisfaction of Owner.

c. Tight wood sheathing shall be laid under any materials that are stored on finished concrete surfaces and planking must be laid before moving any materials over these finished areas. Wheelbarrows used over such areas shall have rubber tires on wheels.

d. Contractor has the responsibility for protection of carpeting and all finish flooring during all phases of the Work including after installation.

e. All floors exposed to view as a floor finish shall be protected by overlaying with plywood in all areas subject to construction traffic within and without the building, special care shall be taken to protect all stair finish surfaces including but not limited to flooring, wood in-fill stairs, cabinetry, counters, equipment, etc.

2. HVAC ductwork shall be protected by the Contractor as follows to prevent introduction of contaminants:

a. Ductwork shall be wrapped at the factory using plastic wrap to exclude moisture and contaminants. The wrapping shall not be removed until immediately prior to installation.

b. Ductwork shall not be exposed to moisture or contaminants at any point in the manufacturing, shipping, storage or installation process.

c. Ductwork shall not be staged or stored outside or otherwise exposed to the weather.

d. Ductwork shall be transported only inside of covered vehicles.

e. Once installed, ductwork shall be protected from contamination during the construction process.

1.6 PROTECTION AFTER INSTALLATION

A. Protect installed products, including Owner-provided products, and control traffic in immediate area to prevent damage from subsequent operations.

B. Provide protective coverings at walls, projections, corners, and jambs, sills, and soffits of openings in and adjacent to traffic areas.

C. Cover walls and floors of elevator cabins, and jambs of cab doors, when elevators are used by construction personnel.

D. Protect finish floors and stairs from dirt, wear, and damage:

1. Secure heavy sheet goods or similar protective materials in place, in areas subject to foot traffic.

2. Lay planking or similar rigid materials in place, in areas subject to movement of heavy objects.

3. Lay planking or similar rigid materials in place, in areas where storage of products will occur.

E. Protect waterproofed and roofed surfaces:

1. Restrict use of surfaces for traffic of any kind, and for storage of products.

2. When an activity is mandatory, obtain recommendations for protection of surfaces from manufacturer. Install protection and remove on completion of activity. Restrict use of adjacent unprotected areas.

F. Restrict traffic of any kind across planted lawn and landscape areas.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

END OF SECTION 01 66 00

SECTION 01 71 23 FIELD ENGINEERING

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide and pay for field engineering services required for the Project.

1. Survey work required in execution of the Project.

2. Verify grades, lines, levels and dimensions shown on Drawings.

3. Lay out work from established control points and benchmarks.

4. Coordinate the work of all trades.

5. It may be necessary at times to discontinue portions of Contractor's work in order that the Owner's Representative may check measurements or surveys without interruptions or other interferences that might impair the accuracy of the results. At any time, on request of the Owner's Representative, Contractor shall discontinue its work to such extent as may be necessary for this purpose and shall cooperate in all reasonable means to the extent of providing labor, tools, or materials to assist the Owner's Representative in making measurements and surveys.

6. Notwithstanding anything set forth above, it shall be the sole responsibility of the Contractor to complete the Work within the tolerances of lines and grades as given on the drawings. No direct payment or claim for additional compensation will be allowed the Contractor for any work or delay occasioned by the Owner's Representative establishing or checking lines or grades or making other measurements, and no extension of time will be allowed for such delays.

B. Owner's Representative will identify existing control points and property line corner stakes indicated on the drawings, as required.

1.2 QUALIFICATION OF SURVEYOR

A. The Surveyor shall be a registered civil engineer or registered land surveyor, licensed in the state in which the Project is located and acceptable to the Owner.

1.3 SURVEY REFERENCE POINTS

A. Basic horizontal and vertical control points for the Project are those designated on drawings.

B. Locate and protect control points prior to occupation of the site, and preserve all reference points during construction.

1. Make no changes or relocations without prior written approval of the Architect and Owner.

2. Report to Owner when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3. Require surveyor to replace reference points which may be lost or destroyed.

a. Establish replacements based on original survey control.

C. The Contractor shall provide and shall maintain axis lines on each floor and shall establish and shall maintain grade marks 4' 0" above the finished floor on each floor level.

D. The Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the Work.

1.4 PROJECT SURVEY REQUIREMENTS

A. Prior to start of construction operations, review and verify figures shown on Drawings and on surveys furnished by Owner.

B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means for site improvements, stakes for grading, fill and topsoil replacement, utility slopes and invert elevations, batter boards for structures, foundations, column locations and floor levels, and controlling lines and levels required for the mechanical and electrical trades.

C. From time to time, verify layouts by the same methods.

1.5 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

1. Make available to Architect and Owner on request: field books, notes, logs and other data developed in performing survey and control work.

2. Maintain a record plan at field office for the information and use of all parties, recording reference points, control points and benchmarks.

B. On completion of foundations and major site improvements, prepare a certified survey showing all dimensions, locations, angles and elevations of construction and turn over to Owner. Submit copies of certified survey in accordance with Section 01 78 39 - Record Documents.

C. When all enclosing walls are complete, certify the location and plumb of the walls.

1.6 SUBMITTALS

A. Submit written qualifications of surveyor to Architect and Owner prior to starting survey work.

B. Submit name and address of Professional Engineer to the Architect.

C. Submit documentation to verify accuracy of field engineering work.

D. Submit certificate signed by registered engineer or registered surveyor certifying that elevations and improvements are in conformance, or nonconformance, with Contract Documents.

1. Indicate on record drawings all variations from Contract Drawings.

2. Indicate horizontal locations and elevations of all existing underground utilities encountered during excavation and construction.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 71 23*****

SECTION 01 73 29 CUTTING, PATCHING AND REPAIRING

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the Work or to:

1. Make sure several parts fit together properly.
2. Uncover portions of the Work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Contract Documents.
5. Remove samples of installed work as specified for testing.
6. Repair or restore existing or new surfaces and finishes to match adjacent existing or new surfaces and finishes.

B. Upon written instructions of the Owner's Representative:

1. Uncover designated portions of Work for Architect's observation of covered work.
2. Remove samples of installed materials for testing beyond that specified.
3. Remove Work to provide for the alteration of previously incorrectly installed work.
4. Patch work uncovered or removed.

C. Do not damage or endanger any Work by cutting or altering the Work or any part thereof.

D. Do not cut or otherwise alter the Work of the Owner except with the written consent of the Owner's Representative.

E. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

F. Openings and Chases

1. Build openings, including but not limited to channels, chases and flues as required to complete the Work as set forth in the Contract.
2. After installation and completion of any work for which openings have been provided, build in, over, and around and finish all such openings as required to complete the Work.
3. Furnish and install all sleeves, inserts, hangers and supports required for the execution of the Work.

1.2 SUBMITTALS

A. Submit a written request to the Architect prior to executing any cutting, alteration or excavation which affects the Work of the Owner, or which may affect the structural safety of any portion of the Project. Include:

1. Identification of the Project.

2. Description of the affected Work.

3. The necessity for doing the cutting, alteration or excavation.

4. The effect on the Work of the Owner's property, or on the structural integrity of the Project.

5. Description of the proposed Work:

a. The scope of cutting, patching, alteration, or excavation.

b. Contractor and trades who will execute the work.

c. Products proposed to be used.

d. The extent of refinishing to be done.

6. Alternatives to cutting, patching or excavation.

7. Designation of the responsibility for the cost of cutting and patching.

8. Written permission of any separate contractor whose work will be affected.

B. Should conditions of the Work or the schedule indicate a change of products from the original installation, submit a request for substitution as specified in Section 01 25 00 - Substitutions and Product Options.

C. Submit a written notice to the Architect and the Owner designating the date and the time the Work will be uncovered.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity for load-deflection ratio.

1. Obtain written approval of the cutting and patching proposal before cutting and patching structural elements, including but not limited to the following:

a. Foundation construction

b. Bearing and retaining walls

c. Structural concrete

d. Structural steel and lintels

e. Structural decking

f. Miscellaneous structural metals

g. Exterior wall back-up supports and anchoring systems

h. Piping, ductwork, vessels, and equipment supports

i. Equipment supports

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operation life or safety.

1. Obtain written approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment

b. Air or smoke barriers

c. Water, moisture, or vapor barriers

d. Membranes and flashings

e. Fire protection systems

f. Control systems

g. Communication systems

h. Electrical wiring systems

i. Operating systems of special construction for MEP work

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Owner's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner at no expense to the Owner.

D. Waterproofing and Water Tightness: Do not cut or alter waterproofed walls or floors or any structural members without written permission of the Owner.

1. Waterproofing and Roofing Membranes

a. Employ qualified contractors to accomplish all required cutting, patching, or repairing of existing waterproofing and roofing membranes.

b. Before beginning cutting, patching or repairing of existing waterproofing and roofing membranes, obtain approval of all materials, methods and contractor to be used from the Owner and agency, or agencies, holding bond or guarantee/warranty in force for membrane.

2. Water Tightness

a. The Contractor shall be responsible for water tightness of product, materials, and workmanship, including work specified to be watertight and inferred by general practice to be watertight.

b. All floors (slabs), walls, roof, glazing, windows, doors, sleeves through foundation walls, flashings, and similar items shall be watertight.

c. If details or materials shown or specified are felt not satisfactory to produce water tightness, the Contractor shall inform the Owner's Representative before installation and submit proposed substitution or alternative method for review and approval. The Contractor shall execute approved change and make watertight at no additional cost to the Owner.

1.4 WARRANTIES

A. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

2.0 PRODUCTS

2.1 MATERIALS

A. Comply with the Contract Documents for each product involved.

B. Use materials identical to in-place or existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or surpass that of in-place or existing materials, and will match visual appearance of in-place or existing materials.

3.0 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of the Project, including elements subject to damage or to movement during:

1. Cutting and patching.

2. Excavation and backfilling.

B. After uncovering Work, inspect the conditions affecting the installation of products, or performance of the Work.

C. Report unsatisfactory or dubious conditions to the Architect in writing; do not proceed with the Work until the Architect has provided further instructions.

3.2 PREPARATION

A. Provide shoring, bracing and other support as necessary to assure the structural safety of that portion of the Work.

B. Provide devices and methods to protect other portions of the Project from damage.

C. Provide for vertical and lateral support required to protect adjacent buildings and properties.

D. Provide protection from the elements for that portion of the Project which may be exposed by cutting and patching work, including but not limited to pumping to maintain excavations free from water.

E. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods which will assure safety, will be least likely to damage elements retained or adjoining construction, and will provide proper surfaces to receive new work.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carbon saw or a diamond-core drill.

4. Comply with the requirements of applicable MEP work where cutting and patching of services is required.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

3. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

    a. For continuous surfaces, refinish to nearest intersection.

    b. For an assembly, refinish the entire unit.

4. When patching existing plaster finished walls and partitions, the Contractor shall utilize plaster trim, lath and other metal components to match the integrity of the existing system. All plaster finishes shall match existing finishes so as to provide a uniform visual appearance.

5. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

6. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

7. Concrete Masonry Units: Patch walls by toothing-in units using salvaged or new CMU units matching in-place units for type and size. Match coursing patterns, mortar joint profiles, and other features of in-place CMU walls. Use accessory materials compatible with in-place materials.

8. Brick and Masonry: Patch walls by toothing-in units using salvaged or new brick and masonry matching in-place brick and masonry units. Match coursing patterns, mortar joint profiles, and other features of in-place brick and masonry walls. Use accessory materials compatible with in-place materials.

9. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

    a. Existing Roofing: Comply with requirements of existing roofing manufacturer for cutting and patching existing roofing system. Provide flashing and trim, base sheets, base flashing, adhesives, insulation, blocking, substrate boards, accessories, and other required items to patch roofing at penetrations and roof-top mounted items.

D. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

E. Execute excavating and backfilling by methods which will assure safety, will prevent settlement or damage to other work.

F. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

G. Restore Work which has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.

H. The Contractor shall replace, repair and patch all surfaces of the ground, and of any structure disturbed by its operations and its Work, which surfaces and structures are intended to remain, even if such operations and work are outside the property lines. Such replacement, repair and patching shall be with like material and shall restore surfaces as they existed.

3.4 CLEANING

A. Clean area and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

*****END OF SECTION 01 73 29*****

SECTION 01 77 00 PROJECT CLOSEOUT

1.0 GENERAL

1.1 INSPECTIONS

A. Substantial Completion:

1. Within a minimum of five (5) days prior to substantial completion, when the Work has reached such a point of completion that the building or buildings, equipment and apparatus can be occupied and used for the purpose intended, the Contractor shall conduct a detailed inspection of the Work to ensure that all requirements of the Contract have been met and that the Work is complete and is acceptable. Contractor shall prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

2. After receipt of the Contractor's initial punch list, the Architect will make an inspection of the Work to determine that the Work is substantially complete and that requirements of the Contract have been met and that the Work is sufficiently complete and is acceptable for use. The Architect will submit a marked-up list of items to be completed and/or corrected, inclusive of the Contractor's punch list, with an estimated dollar value for each item.

3. The Architect shall prepare a Certificate of Substantial Completion, template provided by the Owner, on the basis of an inspection, when the Architect has determined that the Work is substantially complete.

4. A copy of the report of the inspection will be furnished to the Contractor as the inspection progresses so that the Contractor may proceed without delay with any part of the Work found to be incomplete or defective.

5. All work performed under a Fire Protection System Installation/Alteration Operating Permit shall be inspected by the Ithaca Fire Department, or if so delegated by the Ithaca Building Department and the Owner's Environmental Health and Safety Department.

    a. A member of the Ithaca Fire Department shall witness all acceptance or reacceptance testing of work performed under a Fire Protection System Installation Operating Permit. All testing and inspections shall be in compliance with the applicable NFPA codes as referenced by Section 906.1 of the Fire Code of NYS.

    b. Work classified as a 'Repair' under the Existing Building Code does not require the Ithaca Fire Department to witness the testing of the affected systems. Systems that have been repaired must still be tested as required by the Fire Code of NYS and NFPA.

c. The Ithaca Fire Department Shall Witness the Acceptance or Reacceptance Testing for the Following Conditions:

- Testing of any new installation of a fire alarm, fire suppression, or fire detection system as required by the Fire Code of New York State.
- Hydrostatic testing of sprinkler system where the modification affects more than twenty (20) sprinkler heads and the modified area can be isolated from the rest of the system
- Installation or replacement of a fire pump or drive elements of the fire pump.
- A Fire Alarm System with added or deleted components.
- A Fire Alarm System where the wiring or control circuits have been modified.
- A Fire Alarm System where the control unit (Fire Alarm Panel) has been replaced or the control unit software has been replaced.
- A smoke control system where the master control unit, individual fan control unit, or fan drive unit has been replaced or modified.
- An alternative fire suppression system that has been replaced or the actuation elements have been modified. Except: fusible link replacement.
- A modification or extension of the piping fur a fire standpipe system where a hydrostatic test is required by NFPA 14.

B. Final Acceptance:

1. When the items appearing on the report of inspection have been completed or corrected, the Contractor shall so advise the Architect. After receipt of this notification and Contractor’s certified list of completed items, the Owner's Representative will inform the Contractor of the date and time of final inspection. A copy of the report of the final inspection containing all remaining contract exceptions, omissions and incomplete Work will be furnished to the Contractor.

2. After receipt of notification of completion and all remaining contract exceptions, omissions and incomplete Work from the Contractor, the Architect will make an inspection to verify completion of the exception items appearing on the report of final inspection.

1.2 SUBMITTALS

A. Contractor's List of Incomplete Items: Initial punch list submittal at Substantial Completion.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listing by room or space number. Organize items applying to each space by major element, including categories for individual exterior face elevations, ceilings, individual walls, floors, doors, roof levels, casework, equipment, and building systems.

B. Contractor's Certified List of Completed Items: Final signed punch list submittal at Final Completion.

C. Certificates of Release: Occupancy permits from authorities having jurisdiction.

1.3 FINAL CLEAN UP

A. Upon completion of the Work covered by the Contract the Contractor shall leave the completed Project ready for use and occupancy without the need of further cleaning of any kind and with all Work in new condition and in perfect order. In addition, upon completion of all Work, the Contractor shall remove from the vicinity of the Work all plant, buildings, rubbish, unused materials, concrete forms and other materials belonging to him or used under its direction during construction or impairing the use or appearance of the property and shall restore such areas affected by the Work to their original condition, and, in the event of its failure to do so, the same shall be removed by the Owner at the expense of the Contractor, and the Contractor and/or its surety shall be liable therefore. Final clean-up shall include but not be limited to the following:

1. All finished surfaces shall be swept, dusted, washed and polished. This includes cleaning of the Work of all finishing trades where needed, whether or not cleaning by such trades is included in their respective sections of the specifications.

2. Roofs, utility tunnels, manholes and pipe trenches and spaces between the new and existing Work shall be left thoroughly cleaned.

3. Finished flooring shall be thoroughly cleaned in accordance with the manufacturer’s recommendations.

4. Where the finish of floors has been marred or damaged in any space or area, the entire floor of that space or area shall be refinished as recommended by the manufacturers of the flooring.

5. All equipment shall be in an undamaged, bright, clean, polished and new appearing condition.

6. All new glass shall be washed and polished, both sides. The Contractor shall be responsible for all breakage of glass in the area of the Work from the commencement of its activities until the building is turned over to Owner. The Contractor shall replace all broken glass and deliver the entire building with all glazing intact and clean.

7. Provide new filters for all fan convectors after final cleaning.

8. Refer to exterior clean up. Remove paint and glazing compound from surfaces.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by construction operations. Return adjacent areas to condition existing before construction operations began.

C. Cleaning of Renovated Duct Systems and Existing Duct Systems in Renovated Areas:

1. Cleaning work shall be performed by firm which has minimum three (3) years' experience in mechanical cleaning of air systems. Work shall be done by skilled mechanics, technicians and experienced supervisors.

2. Clean dirt, dust and debris from air units, associated equipment air ducts; sanitize same. Cleaning shall include:

a. Cleaning of air unit's supply, return and exhaust sections including coils, fans, filter racks, outdoor air intake shaft, and interior surfaces.

b. Cleaning of dampers, heating coils, humidifiers, and similar devices in ductwork.

c. Marking of duct-mounted damper settings, prior to cleaning, and returning dampers to marked positions after cleaning. This includes fire dampers, zone dampers, balancing dampers and volume dampers.

d. Cleaning of terminal supply, return and exhaust grilles, registers and diffusers.

e. Cutting of access holes in ductwork for cleaning process, as well as sealing and patching of same.

f. Removal of portions of duct system which cannot otherwise be thoroughly cleaned, and replacement thereof.

g. Sealing of lined duct systems, upon completion.

h. Removal and reinstallation of ceiling panels, tiles, ceiling support tracks, and other ceiling construction, as required to facilitate cleaning.

i. Providing access doors required to facilitate cleaning.

3. Cleaning shall meet National Air Duct Cleaners Association (NADCA) Standards, capable of verification by NADCA Vacuum Test. Cleanliness shall be subject to Architect's visual review; provide re-cleaning as necessary to satisfy Architect

a. Cleaning methods may include vacuuming, brushing, mechanical brushing, scraping, or air washing. Use method best suited for locations involved.

b. Do NOT use methods which could damage the system or the building.

c. Remove dirt, dust, lint and other accumulations by HEPA filtered air machine capable of minimum 6000 cfm. Air machine shall operate to obtain 1250 fpm across the workspace. Use brushes, mechanical agitators or air whips to dislodge contaminants to be collected by the air machine.

d. Cleaning shall begin at the furthest point of the return system and at the outdoor air intake. Cleaning shall proceed toward the air handling equipment. Cleaning shall finish at the furthest point of the supply ductwork.

1.4 MAINTENANCE STOCK

A. Turn over to Owner's Representative the maintenance stock specified. Contractor shall obtain signed receipt from Owner's Representative for all maintenance stock.

1.5 ON-SITE CONSTRUCTION TRAILER REMOVAL

A. Within fifteen (15) days of removal of on-site construction trailers, contact Cornell Facilities Inventory Office to notify them of removal to allow for updating of Campus Police 911 Emergency Response System.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 77 00*****

SECTION 01 78 22 FIXED EQUIPMENT INVENTORY

1.0 GENERAL

1.1 FIXED EQUIPMENT INVENTORY

A. The Owner shall provide the Contractor with a list of Equipment Types to be inventoried and an Excel template.

B. The Contractor shall populate the template (see Example Equipment List to be inventoried in Section 1.2). Once populated, the Contractor shall electronically return to the list to the Owner's Representative. The initial data to be captured on each piece of equipment shall include:

1. Name of Product
2. Equipment Classification
3. Manufacturer
4. Model Number
5. Serial Number
6. Cost
7. Location (including Building and Room Number)
8. Acquisition Date (Date of Installation)

C. The Owner shall from the Contractor provided data, create a follow-up equipment Excel template that contains the MAXIMO ID for the equipment with all the name plate and specification fields for each type of equipment. This template shall then be returned to the Contractor.

D. The Contractor shall be responsible for the initial labeling of the equipment and its' disconnects with the MAXIMO ID using an electronic label maker. ID labels shall be in close proximity to Equipment Identification information, visually locatable from the access point to the equipment and on the face of disconnects.

E. The Contractor shall then populate the MAXIMO Equipment Specification Template with the equipment nameplate, specification information, and warranty information. The Contractor shall electronically submit the equipment data and any related documentation (i.e. - O&M manuals) to the Owner's Representative.

F. EXAMPLE EQUIPMENT LIST

- Building Equipment
- AC Drive/VSD
- Air Dryer
- Backflow Preventor
- Air Compressor
  - Building
  - Sprinkler
  - Control
  - Vacuum
- Pump
  - Condensate
  - Glycol
  - CWC
  - HWC
  - Potable
  - Sanitary Sewer
  - Storm Sewer
  - Sump
  - Quality Water
  - Fuel
- Fan
  - Exhaust
  - Supply
  - Return
- Fume Hood
- Furnace
- Generator
- Hot Water Heater
- Heat Exchangers
- Boiler
- Tank
- Unit Heater
- Fan Coil
- VAV Box
- Transfer Switch
- Motor
  - Pump
  - Fan
- Lift/Levelers
- Water Softener
- Reverse Osmosis

1.2 ROOF SYSTEM INVENTORY

A. The Owner shall provide the Contractor with a list of Roof System Attributes to be inventoried in an Excel template and the FM Global form 2688 for roofs.

B. The Contractor shall provide a dimensioned roof plan of the facility drawn to scale, Auto CAD or Microstation format. Each roof panel of the roof system is to be labeled with a unique ROOF ID number that will reference the Excel template to properly inventory Roof System Attributes of each panel. Once populated, the Contractor shall electronically return to the drawings to the Owner's Representative for review and approval.

1. Entire Roof Replacement Projects for a Facility: The Contractor is to assign a ROOF ID to each panel of the newly installed roofing system. The ROOF ID will be comprised of the unique Cornell Facility Code number followed by an underscore and a three digit number. (i.e. - Day Hall (Facility Code: 2026) - ROOF ID: 2006_001).

2. Partial Roof Replacement Projects for a Facility: The Owner will provide a graphically representation of the facility's roof plan with the ROOF ID numbers already assigned to each panel of the roof . The Contractor is responsible to transfer the assigned ROOF ID numbers to their new drawings to be returned to the Owner's representatives.

C. The Contractor shall populate the template. Once populated, the Contractor shall electronically return the list to the Owner's Representative. The initial data to be captured on each panel of the newly installed roof system shall include:

1. Roof Classification
2. Manufacturer (If applicable)
3. Description of System
4. Roof Material
5. Installation Type
6. Slope of Roof (Low or Steep)
7. Roof ID (See Section 1.1.B) for additional information
8. Area of Roof Panel (SF)
9. Contractor (Installer of Roof System)
10. Warranty Number (If applicable)
11. Warranty Expiration Date (If applicable)
12. Material Warranty Number (If applicable)
13. Material Warranty Expiration Date (If applicable)
14. Asbestos Present (If any material remained in place during the reroofing project)

15. Insulation (Yes or No), Fastening type, Thickness
16. Flashing Material
17. Gutter Type (If applicable)
18. Downspout Type (If applicable)
19. Roof Drain Type (If Applicable)
20. Roofing Substrate
21. Facility (State or Endowed)
22. Vapor Barrier Type
23. Installation Date
24. Cost per Square Foot
25. Remaining Useful Life (RUL)
26. Type of Heat Trace Element (If applicable)
27. Type Snow Guard Systems (If applicable)
28. Additional Comments as Applicable

D. The Contractor shall electronically submit the Roof System data as specified above and any related documentation (i.e. - O&M manuals and Warranty data) to the Owner's Representative.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 78 22*****

SECTION 01 78 23 OPERATING AND MAINTENANCE DATA

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

1. Prepare operating and maintenance data as specified in this Section, as referenced in other pertinent sections of Specifications and as necessary to operate the completed Work.

2. Operations and maintenance data, in final format, shall be available to the Owner prior to substantial completion.

B. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.2 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Upload electronic files to ePM system of complete manual in final form.

1. Format:

a. Size: 8-1/2" x 11”.

b. Text: Manufacturer's, scanned .pdf and/or neatly typewritten Word file.

c. Drawings in electronic format

- Drawings are required in PDF format. Drawings shall be in AutoCAD v14 or higher format.

d. Provide divider for each separate product, and major component parts of equipment.

- Provide type description of product, and major component parts of equipment.

- Provide indexed PDF bookmarks.

- Provide a series of files organized in subdirectories with a summary index with hyperlinks to the various documents.

e. Cover: Identify each volume with title "OPERATIONS AND MAINTENANCE INSTRUCTIONS".

List:

- Title of Project
- Identity of separate structure as applicable.
- Identity of general subject matter covered in the manual.

1.3 CONTENT OF MANUAL

A. Table of contents, typewritten, for each volume, arranged in a systematic order.

1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to the content of the volume.
3. List, with each product, the name, address and telephone number of:
   a. Subcontract or installer.
   b. Maintenance contractor, as appropriate.
   c. Identify the area of responsibility of each.
   d. Local source of supply for parts and replacement.
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete reference to inapplicable information.

C. Submittal Data:

1. Include a record copy of the final, approved product submittal. Record copy shall be a clean copy (free of notes from the design professional) which has been updated to reflect the “as-installed” system.

D. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.

b. Control and flow diagrams.

2. Coordinate drawings with information on Record Documents to assure correct illustration of completed installation.

3. Do not use Record Documents as maintenance drawings.

E. Written text, as required to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.

2. Provide a logical sequence of instructions for each procedure.

F. Original copy of each warranty, bond, and service contract issued.

1. Provide information sheet for Owner's personnel, give:

a. Proper procedures in the event of failure.

b. Instances which might affect the validity of warranties or bonds.

1.4 MANUAL FOR MATERIALS AND FINISHES

A. Upload electronic files to ePM system.

B. Content, for architectural products, applied materials and finishes:

1. Manufacturer's data, giving full information on products:

a. Catalog number, size, and composition.

b. Color and texture designations.

c. Information required for reordering special-manufactured products.

d. Certification as to asbestos free

2. Instructions for care and maintenance:

a. Manufacturer's recommendation for types of cleaning agents and methods.

b. Cautions against cleaning agents and methods which are detrimental to the product.

c. Recommended schedule for cleaning and maintenance.

C. Content, for moisture-protection and weather-exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards

b. Chemical composition

c. Details of installation

2. Instructions for inspection, maintenance, and repair.

D. Additional requirements for maintenance data: The respective sections of Specifications.

1.5 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Upload electronic files to ePM system.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.

a. Function, normal operating characteristics, and limiting conditions.

b. Performance curves, engineering data and tests.

c. Complete nomenclature and commercial number of all replaceable parts.

2. Operating procedures:

a. Start-up, break-in, routine and normal operating instructions.

b. Regulation, control, stopping, shut-down and emergency instructions.

c. Summer and winter operating instructions.

d. Special operating instructions.

3. Maintenance Procedures:

a. Routine operations.

b. Guide to "trouble-shooting".

c. Disassembly, repair and reassembly.

d. Alignment, adjusting and checking.

4. Servicing and lubrication required:

a. List of lubricants required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

    a. Predicted life of parts subject to wear.

    b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

9. Each contractor's coordination drawings.

    a. As-installed color coded piping diagrams.

10. Charts of valve tag numbers, with the location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of Specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts:

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data and tests.

    c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panel boards:

    a. Electrical service.

    b. Controls.

    c. Communications.

3. As-installed color coded wiring diagrams.

4. Operating procedures:

    a. Routine and normal operating instructions.

    b. Sequences required.

    c. Special operating instructions.

5. Maintenance procedures:

   a. Routine operations.

   b. Guide to "troubleshooting".

   c. Disassembly, repair and reassembly.

   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of Specifications.

D. Additional requirements for operations and maintenance data: See the respective sections of Specifications and General Conditions.

1.6 SUBMITTAL REQUIREMENTS

A. Submit through ePM system preliminary draft of proposed formats and outlines of contents of the O&M Manual thirty (30) calendar days after approved submittals.

B. Submit completed data in final form twenty (20) calendar days prior to the Acceptance Phase (final Payment Application) of the Project.

1.7 INSTRUCTIONS OF OWNER'S PERSONNEL

A. Prior to final inspections or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems:

1. Instruction time shall be sufficient to fully instruct all shifts of the Owner's operating and maintenance personnel.

B. Operations and maintenance shall constitute the basis of instruction:

1. Review contents of manual with Owner personnel in full detail to explain all aspects of operations and maintenance.

C. Submit documentation, signed by each of the Owner's Representatives who have been instructed, describing:

1. Method of Instruction.

2. Equipment and Systems Operated.

3. Length of Instruction Period.

D. Contractor is fully responsible until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing.

1.8 OPERATING INSTRUCTIONS

A. Upload in ePM system all operating, maintenance and starting precautions and procedures to be followed by Owner for operating all systems and equipment.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 78 23*****

SECTION 01 78 36 WARRANTIES AND BONDS

1.0 GENERAL

1.1 DESCRIPTION

The Contractor shall:

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Architect for transmittal to Owner.

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General closeout requirements are included in Section 01 77 00 - "Project Closeout."

3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 through 40.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner

1.4 QUALITY ASSURANCE

A. Use adequate care and diligence to review Contract Documents to identify detailed requirements relating to warranties and bonds.

B. Verify that each item required for this submittal conforms with specified requirements.

1.5 WARRANTY REQUIREMENTS

A. In addition to standard and special warranties described in Divisions 2 through 40, Contractor shall warrant work included in this Project, for a minimum period of one (1) year following acceptance of a Certificate of Substantial Completion by Owner, to cover performance, materials, workmanship and compliance with Contract Documents.

B. Corrective Work: Provide service within thirty (30) calendar days when requested by Owner. Perform services during normal working hours, unless specifically directed otherwise by Owner. Coordinate with Owner's representative to schedule performance of corrective work. Where designated service providers cannot perform corrective work within the Owner's required time frame, engage another qualified service provider. Submit a written statement to Owner upon completion of corrective work; document work performed and list outstanding items, if any.

1. When a completed breakdown of a piece of equipment occurs of the malfunction of a system affects the environment or program involving 50 or more persons at a time (employees and students combined), or creates a safety or security risk to the Owner, an EMERGENCY may be declared by the Owner. The Owner may declare an emergency as defined above at which time the service response must be within 4 hours and may require action during non-normal working hours.

2. When an emergency condition occurs, the Owner may take immediate corrective action to relieve the problem by making, a minimum as possible, temporary adjustments and/or repairs when necessary to decrease the problem until the designated Contractor's representative can respond. These temporary adjustments and repairs will in no way jeopardize the existing warranty.

3. The Owner's service staff will advise the Contractor's Representative of all temporary adjustments and repairs done in relation to the malfunctioning equipment or facility.

4. If the Contractor fails to respond with actual service within four (4) hours, and/or the necessary repairs or adjustments are not satisfactorily complete twenty-four (24) hours, the Owner will have the authority to make the necessary repairs or adjustments and charge the Contractor for parts and labor.

5. If all adjustments and repairs done by the Owner in relation to the above conditions are done by authorized district personnel, there will be no negative effect of future warranty claims.

C. Related Damages and Losses: When correcting failed or damaged warranted work, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

D. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

E. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

F. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

G. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or subcontract for materials or units of work for Project where a special project guaranty, specified product warranty, certification, or similar commitment is required until it has been determined that entities required to sign or countersign such commitments are willing to do so.

H. Specific Warranty. Where a special warranty, certification, or similar commitment is required on such work or part of the Work, the Owner reserves the right to refuse to accept the Work until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.6 SUBMITTAL REQUIREMENTS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect or Owner.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect and Owner within fifteen (15) days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for acceptance prior to final execution.

1.7 SUBMITTALS REQUIRED

A. Submit warranties, bonds, and service and maintenance contracts as specified in the respective sections of Specifications. Submit a list of all required warranties.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 FORM OF SUBMITTALS

A. The Warranties and Bonds shall be in electronic pdf format. Each submission shall include the title of the Project and the name of the Contractor.

B. Provide a series of files organized in subdirectories with a summary index with hyperlinks to the various documents and or references.

C. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

D. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Item description.
3. Notation of what the equipment serves (e.g. – Provides perimeter heat)
4. Warranty Provider. Is the warranty provided by a manufacturer or installer?
5. Firm, with name of principal and responsible party, address and telephone number.
6. Scope.
7. Duration.
    a. Date of beginning of warranty, bond or service and maintenance contract
    b. End date of warranty, bond or service and maintenance contract.
8. Provide information for Owner's personnel:
    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.
9. Contractor, name of responsible principal, address and telephone number.

3.2 TIME OF SUBMITTALS

A. Make final submittals within ten (10) days after Date of Substantial Completion, prior to final request for payment.

B. For items of work when acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.

3.3 ROOF WARRANTY PACKAGE

A. Roof warranties shall explicitly denote the specific roof panel identification number (ROOF ID) for which the warranty applies to.

B. Roof panel identification numbers shall be generated in accordance with Section 01 78 22, FIXED EQUIPMENT INVENTORY, in coordination with the Owner's Roof Representative.

C. Roof warranties shall include a dimensioned roof plan with roof panel identification numbers generated in accordance with Section 01 78 22, FIXED EQUIPMENT INVENTORY.

D. Warranty Needs to be posted at all access points to the roof, With following message.

Attention
Roof Under Warranty
Do Not Alter or Repair without written
Approval from Facilities Services
Manufacture: XYZ
Installation Date: 00/00/0000
Warranty Number: 123
Warranty Expiration Date: 00/00/0000
For Immediate Assistance Contact
Roof Program Manager

*****END OF SECTION 01 78 36*****

SECTION 01 78 39 RECORD DOCUMENTS

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall maintain at the site, during construction, one record copy of:

1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract
5. Architect's Field Orders or written instructions.
6. Final Shop Drawings, Product Data and Samples
7. Field Test records
8. Construction photographs

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide cabinet or storage space for storage of samples.

B. File documents and samples in accordance with the Owner’s electronic project management system document structure.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for review by the Owner’s Representative and the Architect.

1.3 RECORDING

A. Label each document "AS BUILT" in neat large printed letters.

B. Record information concurrently with construction progress.

1. Do not conceal any Work until required information is recorded.

C. Survey Mapping

1. Provide an accurate topographic, planimetric, utility map of as-built conditions, and mapped locations and elevations of constructed facilities / elements including as-built and exposed underground utilities. Survey work in progress as required to accurately locate constructed facilities / elements. Survey final condition of project extents at final acceptance.

   a. Site related elements including:

      - Sidewalks, ramps, curbs, and gutters - indicate type and surface material.

      - Streets, driveways, parking areas, labeled with material.

      - Fences, walls, steps, handrails, signs, site furniture and light fixtures labeled with material.

      - Live trees which have a trunk diameter of three inches (3") or greater and all isolated or specimen trees. Measure tree trunk 3' above grade. Indicate approximate trunk diameter, "drip line" and common name of tree.

      - Shrubs, show outlines of shrub masses.

      - Streams and bodies of water.

   b. Utility related elements and supporting infrastructure including:

      - The Contractor shall provide GPS points on all utility infrastructure: water, steam, chilled water, storm, sewer, electric, telecommunications, etc. Data is to be sent to the Owner on a quarterly basis throughout the project.

      - Manholes, catch basins, drain inlets, cleanouts, vent stacks, tanks, underdrains, foundation drains, monitoring wells, detention/retention/filtration facilities. Label type (sanitary or storm), dimensions and material of structure and cover/grate; pipe connections; sizes, materials, direction of flow and invert elevations. Locate and identify size, material, and invert elevations for culverts.

      - Water, gas, central steam, chilled water or other pressure lines, valve boxes, meter boxes, hydrants, tanks, fittings, etc. Label type, size, material, elevations at building walls and all intersections, connections and vertical angle changes.

      - Utility poles, above and below ground lines including but not limited to power, street lighting, traffic control communication and sensors, telephone, television, communication, fire and police call boxes, public communication or display facilities. Label utility as direct buried, in conduit, or concrete encased duct. Identify elevations at building walls and all intersections, connections and vertical angle changes. Label all utilities and associated duct banks or conduits with sizes and materials.

- Existing and abandoned utilities exposed during construction. Show ends of abandoned utilities left in place and assumed continued direction of utilities. Label with information as listed above.

2. Survey mapping shall be done under the personal supervision of a Surveyor, registered in and licensed by the State of New York, who shall certify under his/her seal the accuracy of the survey.

3. Field Survey Accuracy:

   - Horizontal and Vertical mapping shall be ACSM Second Order Class II, 1 in 20,000.

4. Coordinate base:

   - NAD83-86 geodetic system with grid values in the New York Central State Plane coordinate system in feet with elevations in NAVD ’88 in feet.

5. Each different feature shall be drafted on a separate named CAD level/layer in Revit or AutoCAD format using industry standard symbology of color, line style, line weight, and cells.

6. Provide an ASCII file list of coordinates for all survey points including control, feature, and topographic in the following comma delimited format: Point number, Northing coordinate, Easting coordinate, Elevation coordinate, Point description.

7. Topography and spot elevations:

   a. Topographic contours shall be accurately plotted at one foot (1’) contour intervals.

   b. Record spot grade elevations as follows:

      i. Within natural ground and lawn and planted areas, spot elevations shall be shown to one-tenth of a foot (0.1’). Within all areas of built-up improvements such as pavements, curbs, steps, walls, utility and drainage systems or other site improvements, spot elevations shall be shown to one-hundredth of a foot (0.01’).

      ii. Existing grade at building corners; and thresholds and finished floor at all entrance, exit, or access points.

      iii. Develop road cross sections at 50-foot intervals maximum, record spot elevations for all drive centerlines and all beginning radius of street intersections. For each cross section obtain elevations for front and back of existing sidewalk, top and bottom of curb, and centerline of the street. Obtain elevations for centerline intersection of all roads.

iv. For trees of three inches to eighteen inches (3" - 18") in diameter, record elevation at high and low side at base of trunk. For specimen trees of eighteen inches (18") or greater diameter, indicate four (4) spot elevations on the north, south, east, and west at base of each trunk to one-hundredth (.01) foot elevation.

v. Base, top, corners, and at cheek walls for all steps. Indicate elevations at top and bottom of walls and curbs.

vi. Rim elevations of all catch basins, drain inlets, manholes, valve boxes, slabs on grade. Inverts at all sewer pipes and culverts. Bottom of structure floor and sump.

D. Drawings

As built drawings shall consist of making any changes neatly and clearly on the Contract Drawings using colored ink or pencil, shall be kept current by the contractor on a day-to-day basis in concert with the progress of the Work. Where applicable, the change marked on a drawing is to carry the notation "per Change Order No. X", or similar reference which cites the reason for the change. As an alternative approach the Contractor can submit a plan for producing the "As-Built" drawings via electronic mark-up in Bluebeam, Adobe Professional, or other similar program as an alternative to colored pencil or ink mark-ups. Such plan shall be subject to approval of the Owner.

The day-to-day construction as built drawings shall be made available to the Architect or Owner's Representative for review upon request. The "As built" drawings shall show all changes to the following areas of construction:

1. Architectural:

   a. Modifications to components dictated by the building code

   b. Wall, door, window locations

   c. Built in casework locations

   d. New rated door and wall schedules/ locations

   e. Material and products where submittals are requested

2. Civil and Structural

   a. Dimensions for load carrying elements, both horizontal and vertical

   b. Materials and products where submittals are requested

   c. Load carrying elements and foundation systems

   d. Site related elements including:

      - Building outlines, entranceways, areaways, roof overhangs, downspouts, significant architectural projections and other pertinent data.

e. All significant changes in foundations, columns, beams, openings, concrete reinforcing, lintels, concealed anchorages and "knock-out" panels made during construction.

f. Building envelope systems including roofing systems and building shell systems

g. Geotechnical subsurface information

h. Items that will require future maintenance

i. Life safety critical items

3. Mechanical (HVAC, Plumbing and Fire Protection)

a. Products where submittals are requested

b. Final locations of all equipment.

c. Final sizes and materials of piping and ductwork.

d. Final locations of inaccessible piping and ductwork.

e. Final locations of all controls equipment, including all sensors and actuators.

f. Final locations of all valves and dampers, including all shutoff valves, balance dampers and fire dampers.

g. Location of access doors for all equipment in concealed locations.

h. Final location and arrangement of all mechanical equipment and concealed gas, sprinkler, domestic, sanitary and drainage systems piping and other plumbing, including, but not limited to, supply and circulating mains, principal valves, meters, clean-outs, drains, pumps and controls, vent stacks, sanitary and storm water drainage.

4. Electrical

a. Products where submittals were requested.

b. Circuit (wire and raceway) size, number, and type.

c. Main circuit pathways for Fire Alarm, Emergency Power, and Access Control/Security systems.

d. Final locations of equipment and devices, interior and exterior luminaires, and power supplies.

e. Final location of electric signal system panels, final arrangement of all circuits and any significant changes made in electrical signal system design as a result of Change Order or job conditions.

5. Environmental

    a. Utility related elements and supporting infrastructure

    b. Storm water maintenance/testing access points

    c. Location of unusual excavation findings / contaminated soil (i.e. mercury uncovered during excavation, also on-site spills during construction), including quantity excavated/disposed.

E. Specifications and Addenda

Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

1.4 SUBMITTAL

A. After completion of Punchlist, deliver copies of all record documents to the Owner's Representative.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date

2. Project title and number

3. Contractor's name and address

4. Title and number of each record document

5. Certification that each document is complete and accurate

6. Signature of Contractor or its authorized representative.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 78 39*****

SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS

1.0 GENERAL

1.1 SUMMARY

A. This section includes general administrative and procedural requirements for the commissioning process to supplement other general commissioning process activity sections and other technical sections that specify testing of components, systems and assemblies.

B. Related Sections include the following:

1. Division 01 Section “Facilities Exterior Enclosure Commissioning” for commissioning process activities for building exterior enclosure, roof, and foundation systems, assemblies, equipment, and components.

2. Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.

3. Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

4. Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.

C. The BACS Trade’s responsibilities for commissioning and check-out include the following:

1. Provide all logic, graphics, and trends for review prior to the start of field commissioning activities.

2. Provide a complete calibration and operational check for each individual point and function contained within the BACS.

3. Conduct the checkout with the use of point/function log sheets to be prepared by the contractor. The Owner shall approve the log sheet format.

4. Submit log sheets to the Owner prior to the commencement of any final acceptance testing.

5. Certify, in writing, to the Owner prior to the commencement of final acceptance testing that all components of the BACS are functioning as per the requirements of the contract documents.

6. Provide to the Owner as-built drawings and documentation at least four (4) weeks prior to the commencement of any final BACS acceptance testing. Ensure all trends and graphics are completed and approved by Cornell.

7. The BACS contractor shall issue a report upon project completion stating that the system is complete, has been adjusted, and has had all hardware and software functions verified, that all analog control loops are tuned, and is operating in accordance with the specifications. Any deviations from specified settings or operations necessitated during system adjustment shall be specifically noted.

8. The Contractor shall check out the installation with a representative from Cornell's Energy Conservation Control Team. The checkout shall consist of verifying the ability of the BACS to communicate with the central EMCS system, verifying the calibration of each sensor and/or transmitter, and verifying the operation of each control point.

9. All software processes shall be thoroughly demonstrated to the Owner's representative. Alarm conditions shall be simulated for conformance. Analog control points shall be exercised through their entire range. All control interlocks and sequences shall be completely verified. The checkout shall be a thorough and exhaustive review of the installation to assure proper operation of the total system.

1.2 DESCRIPTION

A. Commissioning is a systematic process of confirming that all building systems perform interactively according to the Owner's Program Requirements and the Basis of Design and continuing through construction, acceptance and the warranty period with actual verification of performance.

B. Commissioning during design is intended to achieve the following specific objectives:

1. Verify the Owner's Program Requirements and Basis of Design are clearly documented and they meet the Owner's goals and objectives.

2. Provide Design Review during AE design efforts.

3. Verify commissioning for the construction phase is adequately reflected in the bid documents.

C. Commissioning during the construction phase of this project is intended to achieve the following specific objectives:

1. Provide direction for the commissioning process during construction, particularly providing resolution to issues and providing details not developed during design (ex. scheduling, participation of various parties, lines of reporting and approvals, coordination, etc.)

2. Verify that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.

3. Verify and document proper performance of equipment and systems.

4. Verify that O&M documentation left on site is complete.

5. Verify that the Owner's operating personnel are adequately trained.

D. The Commissioning process does not take away from or reduce the responsibility of the system designers to design a workable system nor the installing contractors to provide a finished and fully functioning product.

E. The CxA directs and coordinates the commissioning activities and reports to the Owner. All members in the construction process work together to fulfill their contracted responsibilities and meet the objectives of the Owner's Project Requirement's as detailed in the Contract Documents.

F. The CxA works with the CM/GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CM/GC and Owner for scheduling commissioning activities. Meanwhile, the CxA will integrate these activities into the master construction schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

G. The following narrative provides a brief overview of the commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a Commissioning Kick-Off Meeting – Construction Team conducted by the CxA where the commissioning process is reviewed with the commissioning team members.

2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.

3. Equipment documentation is submitted to the CxA through the submittal process, including detailed start-up procedures.

4. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with Pre-functional checklists being completed before functional testing begins.

5. The contractors, under their own direction, document and perform startup and initial checkout. The CxA documents that startup was completed according to the approved plans, when contracted. This may include the CxA witnessing start-up of selected equipment, if contracted.

6. The CxA verifies installation integrity through the use of checklists.

7. The CxA develops specific equipment and system functional performance test procedures. The contractors review the procedures.

8. The procedures are executed by the contractors, under the direction of, and documented by the CxA.

9. Items of non-compliance in material, installation or setup are corrected at the contractor's expense and the system retested.

10. The CxA reviews the O&M documentation for completeness.

11. Commissioning is completed before Substantial Completion, whenever possible.

12. The CxA reviews and pre-approves the training plan provided by the contractors.

13. The contractors coordinate and provide training via qualified instructors.

14. Training occurs.

15. The Owner verifies that training has occurred and provides a written statement that training has occurred.

16. Deferred testing is conducted, as specified or required.

1.3 DEFINITIONS

A. Acceptance: A formal action, to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.

B. Acceptance Phase: Phase of commissioning after start-up and initial checkout when functional performance tests, O&M documentation review and training occurs.

C. Architect/Engineer (AE): the prime Consultant (Architect) and Subconsultants who comprise the design team, generally the HVAC Mechanical Designer/Engineer, the Electrical Designer/Engineer and various other Subconsultants.

D. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the contract documents.

E. Basis of Design (BOD): A document that records concepts, calculations, decisions and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. Also known as the Design Criteria.

F. Checklists: Verification checklists that are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements.

G. Commissioning Authority (CxA): An entity identified by the Owner who plans, schedules and coordinates the commissioning team to implement the Commissioning Process. The Owner will engage an engineering firm for the CxA under a separate contract.

H. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

I. Commissioning Process: A quality-focused process for enhancing the delivery of a project and includes verifying and documenting that the facility and its systems and assemblies are planned, designed, installed, tested, operated and maintained to meet the Owner's Project Requirements.

J. Commissioning Process Progress Report: A written document that details activities completed as part of the commissioning process and significant findings from those activities that is continuously updated during the course of a project.

K. Commissioning Report: A document recording the results of the commissioning process, including the record documents, performance of the commissioned systems and documents all sign-offs.

L. Commissioning Specifications: The contract document that details the objective, scope and implementation of the construction and acceptance phases of the commissioning process as developed in the Commissioning Plan.

M. Commissioning Team: A team comprised of the CxA, Owner, AE, Construction Manager/General Contractor, Contractors, maintenance and operations personnel, and occupants. Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action.

N. Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.)

O. Contractor: the CM or Subcontractors authorized representatives.

P. Construction Manager (CM): the prime contractor for this project. Generally refers to all the CM's Subcontractors as well. Also referred to as the Contractor, in some contexts.

Q. Data Logging: The monitoring and recording of flow, current, status, pressure, etc. of equipment using 'stand-alone' data recorders separate from the control system or the trending capacities of control systems.

R. Deferred Performance Tests (DPTs): Performance tests that are performed, at the discretion of the CxA, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.

S. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the Owner's Project Requirements).

T. Equipment Manufacturer: The multiple companies that will manufacturer equipment and products for the commissioned systems and who will participate as required in the commissioning activities.

U. Factory Testing: Testing of equipment on-site or at the factory, by factory personnel, with or without Owner's representative present.

V. Functional Performance Test: The testing of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, etc. The systems are run through all the control system's sequence of operation and components are verified to be responding as the sequences state. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor.

W. General Contractor: The prime contractor for this project. Generally refers to all the GC's Subcontractors as well. Also referred to as the Contractor, in some contexts.

X. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

Y. Issues Log: A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the commissioning team during the course of the commissioning process.

Z. Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').

AA. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.

BB. Non-Compliance: See Deficiency.

CC. Non-Conformance: See Deficiency.

DD. Owner's Project Requirements (OPR): A written document that details functional requirements of the Project and the expectations of how the Project will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information. (Also formerly known as the Design Intent Document.)

EE. Owner's Representative or Project Manager (Owner): The contracting and managing authority for the Owner who oversees the design and/or construction of the project.

FF. Over-written Value: Writing over a sensor value in the control system to see the response of a system.

GG. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of a project or other scheduling issues, in order to minimize the total construction time.

HH. Re-Commissioning Management Manual: A single manual that contains information required for recommissioning the projects' building systems.

II. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

JJ. Seasonal Performance Test: Performance tests that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.

KK. Simulated Condition: Condition that is created for the purpose of testing the response of a system (eg. Raising/lowering the set-point of a thermostat to see the response in a VAV box).

LL. Simulated Signal: Disconnecting a sensor and using a signal generator to simulate a sensor value for the purpose of testing a full range of conditions.

MM. Startup: The initial starting or activating of dynamic equipment, including completing construction checklists.

NN. Systems Manual: A systems focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the occupancy and operations phase.

OO. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

PP. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.

QQ. Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents.

RR. Training Plan: A written document that details the expectations, schedule, budget and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users, and occupants.

SS. Trending: Monitoring over a period of time.

TT. Verification: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

UU. Warranty Period: Warranty period for the entire project, including equipment components, begins at Substantial Completion, and extends typically for Submittals.

1.4 QUALITY ASSURANCE

A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.5 COORDINATION

A. Commissioning Kick-Off Meeting – Construction Team: Contractors will attend a meeting of the Commissioning Team, chaired by the CxA, to review the scope of commissioning process activities and the Commissioning Plan with discussions on milestones, activities, and assignments of responsibilities. The flow and type of documents and the amount of submittal data given to the CxA will be determined. Meeting minutes will then be distributed to all parties by the CxA.

B. Commissioning Meetings: Contractors will attend coordination meetings with the Commissioning Team, chaired by the CxA, to review progress on the Commissioning Plan, construction deficiencies, scheduling conflicts, and to discuss strategies and processes for upcoming commissioning process activities.

C. Miscellaneous Construction Meetings: The CxA attends selected planning and job-site meetings in order to remain informed on construction progress and to update parties involved in the commissioning process.

D. Pre-testing Meetings: Contractors will attend pretest meetings with the Commissioning Team, chaired by the CxA, to review startup reports, pre-test inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

E. Testing: Contractors will coordinate with testing personnel and agencies for timing and access for CxA to witness test.

F. Manufacturers' Inspection and Startup Services: Contractors will coordinate services of manufacturers' inspection and startup services.

G. Testing, Adjusting and Balancing: Contractors will coordinate with plan and schedule for testing, adjusting and balancing for timing and access for CxA to witness process.

2.0 PRODUCTS

2.1 TEST EQUIPMENT

A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by Testing, Adjusting, and Balancing (TAB) in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each Subcontractor.

B. Special equipment, tools and instruments (specific to a piece of equipment and only available from the vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.

C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.

D. Data logging equipment and software required to test equipment will be provided by the CxA, but shall not become the property of the Owner.

E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

3.0 EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. Submittals: See Section 1.5 – SUBMITTALS for requirements.

B. Checklists

1. The CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems.

C. **Red-lined Drawings:** The Contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings. Preliminary red-lined drawings must be available to the Commissioning Team for use prior to start of the Functional Performance Testing. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings. The contracted party, as defined in the Contract Documents will create the as-built drawings.

D. **Operation and Maintenance Data:** Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems. The CxA will review the O&M literature once for conformance to project requirements. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

E. **Demonstration and Training:** Contractor will provide demonstration and training as required by the specifications. A complete training plan and schedule must be submitted by the Contractor to the CxA two weeks (2) prior to any training. A training agenda for each training session must be submitted to the CxA two (2) weeks prior the training session.

3.2 OWNER'S RESPONSIBILITIES

A. Provide the Owner's Project Requirements (OPR) documentation to the CxA and Contractors for use in developing the Commissioning Plan; testing plans and checklists.

B. Provide the Basis of Design documents, prepared by the architect and approved by the Owner, for use in developing the Commissioning Plan; testing plans and checklists.

C. Assign operation and maintenance personnel and schedule them to participate in Commissioning Team activities including, but not limited to, the following:

1. Commissioning meetings.

2. Construction phase coordination meetings.

3. Piping and ductwork testing and flushing verification meetings.

4. Procedures meeting for testing, adjusting and balancing.

5. Testing and demonstration of systems, subsystems and equipment.

6. Training in operation and maintenance of systems, subsystems and equipment.

7. Final review and acceptance meetings

D. Provide utility services required for the commissioning process.

E. Facilitate the coordination of the commissioning work between the CxA, the Contractor and the Architect and Engineers to ensure that the commissioning activities are incorporated into the master schedule.

F. Review and approve the commissioning plan.

G. Coordinate any seasonal or deferred testing.

H. Ensure that any seasonal, deferred testing and/or deficiency issues are addressed.

3.3 ARCHITECT'S DUTIES

A. Attend the Commissioning Kick-Off Meeting – Design Team, Commissioning Kick-Off Meeting – Construction Team and selected team meetings.

B. Perform submittal review, construction observation, as-built drawing preparation, other items as contracted.

C. Provide the Basis of Design Document. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

D. Participate in the resolution of system deficiencies identified during the commissioning, according to the contract documents.

E. Construction Record documents and specifications.

F. Ensure that the CxA's submittals comments are incorporated into the Design Professional's submittal comments prior to sending to CM or GC for distribution.

G. Facility operating procedures for normal, abnormal, and emergency modes of operation.

H. Participate in resolution of design non-conformance and design deficiencies identified during the warranty-period commissioning process.

3.4 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following brief overview:

1. Facilitate the coordination of commissioning and incorporate commissioning activities into the overall project.

2. Provide copies of all applicable submittals as required in Division 01 including all changes thereto.

3. Provide detailed startup procedures.

4. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, perform corrective actions.

5. Cooperate with the CxA for resolution of issues recorded in the Issues Log.

6. Attend commissioning team meetings held on a scheduled basis.

7. Furnish a copy of all construction documents, addenda, change orders, and approved submittals and shop drawings related to commissioned equipment to the CxA. Furnish a copy of the O&M literature to the CxA forty five (45) days after final equipment submittals.

8. In each purchase order or subcontract written, include requirements for submittal data, O&M literature, commissioning tasks and training.

9. Integrate and coordinate commissioning process activities with construction schedule.

10. Review and accept construction checklists provided by the CxA.

11. Review and accept commissioning process test procedures provided by the CxA.

12. Complete commissioning process test procedures.

13. Submit training plan for approval, coordinate training and provide qualified instructors for training of Owner personnel.

14. Assist the CxA as necessary in the seasonal testing, deferred testing and deficiency resolution.

15. Ensure that Subcontractors correct deficiencies and make necessary adjustments to submittals, O&M manuals and red-lined drawings for applicable issues identified in any seasonal testing.

16. Provide written as-built controls drawings and sequences of operation for all equipment.

17. Provide a written list of time of day schedules and a schedule frequency to review them for relevance and efficiency.

18. Provide written recommendations for recalibration frequency of sensors and actuators by type and use.

19. Provide a written list of all user adjustable set-points and reset schedules with a brief discussion of the purpose of each and the range of reasonable adjustments with energy implications

20. Provide a written schedule frequency to review the various set-points and reset schedules to ensure they are current relevant and efficient values.

3.5 EQUIPMENT SUPPLIER'S RESPONSIBILITIES

A. Roles and Responsibilities

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.

2. Assist in equipment testing per agreements with Subcontractors.

3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

3.6 COMMISSIONING AGENT'S RESPONSIBILITIES

A. Roles and Responsibilities

1. The CxA is not responsible for the design concept, the design criteria, compliance with codes, design or general construction scheduling, cost estimating or construction management.

2. The CxA may assist with problem solving and non-conformance items or deficiencies, but the CxA is not the Design Engineer / Engineer of Record, and the commissioning process does not preclude the design engineer / Engineer of Record of responsibilities for system evaluations, adequacy of systems to meet the OPR, capacities of systems, quality control checks, or any of the other elements and recommended final acceptance of systems to the Owner.

3. The primary role of the CxA is to coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultants with all necessary parties, frequently updated timelines and schedules and technical expertise.

B. Commissioning Plan

1. The CxA shall develop a Commissioning Plan at the start of the project. The Commissioning Plan shall outline the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

2. The Commissioning Plan shall be a "living document" in which information is added to or modified by the Commissioning Team during the course of the Project.

3. At the end of the Project, the CxA shall provide the Owner with the Final Commissioning Plan for the Owner's use.

C. Document Review

1. Review the Owner's Project Requirements and Basis of Design developed by the design professionals.

2. Perform a focused review of the drawings and specification during the Design Development and near the end of the Construction Document Phase, if contracted.

3. Develop full commissioning specifications for all systems and equipment to be commissioned. The commissioning specifications will be subject to approval of the design team and included in the final construction specifications.

4. Review submittals applicable to systems being commissioned for compliance for commissioning needs, concurrent with the AE's reviews.

D. Cx Team Meetings

1. Commissioning during construction will begin with a 'Commissioning Kick-Off Meeting – for Construction Team' conducted by the CxA where the commissioning process is reviewed with all of the commissioning team members.

2. Additional meetings may be required throughout construction, and will be scheduled by the CxA on a weekly basis with necessary parties of the commissioning team attending, in order to plan, scope, coordinate, and schedule future activities and resolve problems.

E. Coordination and Scheduling

1. Coordinate and direct commissioning activities in a logical, sequential, and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications, and consultations with all necessary parties.

2. Coordinate commissioning work with the CM/GC to ensure that commissioning activities are being scheduled into the master project schedule.

F. Commissioning Progress

1. Perform site visits, as necessary, to observe component and system installations.

2. Attend selected planning and jobsite meetings to obtain information on construction progress.

3. Review construction meeting minutes for revisions/substitutions relating to the commissioning process.

G. Pipe Testing, Flushing and Cleaning

1. Coordinate with EHS, Cornell Pipe Shop, and other necessary departments.

2. Review and approve the pipe testing, flushing and cleaning plan submitted by the Contractor.

3. Witness all or part of the pipe testing, flushing and cleaning and be sufficiently confident that proper procedures are being followed.

4. Document via the Commissioning Issues Log any deficiencies in the procedures or results.

H. Pre-Functional Checks

1. Verify proper installation of components, equipment, systems and assemblies. Sampling procedures may NOT be employed on systems and equipment.

I. Equipment and System Startup and Verification

1. Review and approve component, equipment, system and assembly startup plan developed and submitted by the Contractor.

2. Approve system startup by reviewing startup reports, if contracted; and by selected site observation.

3. Review the Testing, Adjusting and Balancing execution plan for the project, which shall be submitted by the TAB Subcontractor.

4. Verify and document the accuracy of the air and water systems balancing by spot testing the air and water reported field values with TAB Subcontractors and by reviewing completed reports.

J. Functional Performance Testing

1. With assistance from the Contractor, write Functional Performance Testing procedures for all components, equipment or systems to be commissioned.

2. With the assistance of the Contractors, coordinate Functional Performance Testing. Witness and approve Functional Performance Testing performed by the Contractors.

3. With the assistance of the Contractors, coordinate retesting as necessary until satisfactory performance is achieved.

4. Witness seasonal or deferred Functional Performance Testing as necessary.

K. Issue/Deficiency Logs

1. The CxA shall prepare a formal, ongoing, online record of deficiencies, problems and concerns – and their resolution – raised by members of the Commissioning Team during the Commissioning Process.

2. Issues will be recorded on an online Commissioning Issues Log for the AE, CM/GC and Contractors to resolve to the satisfaction of the Owner. Issues will be added by the CxA. Team members are required to post their own responses to issues pertaining to their work. Team members are required to respond to issues added to the list within five (5) working days of being added by the CxA.

3. Issues will be revisited one (1) time to verify that the proper corrections have been made. The Owner reserves the right to deduct from the Contractors' contract costs associated with additional revisits required for outstanding issues.

4. When issues are resolved, they will be closed on the Issues Log by the CxA.

L. Operation and Maintenance Data

1. The CxA shall review of the documentation submitted by the Contractor as required by the Specifications for completeness and accuracy. This commissioning review supplements, but does not replace, the Architect/Engineer's review.

2. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

M. Training

1. The CM/GC and Contractors will provide all documentation and qualified training personnel for training.

2. The CxA will verify through the Contractor's plan and schedule, training agendas, and select observations that proper training procedures were followed on all commissioned systems.

3. See appropriate section below pertaining to training.

N. Systems Manual Requirements

1. Index of Systems Manual with notation as to content storage location if not in actual manual.

2. Executive Summary

3. A list of recommended operational record keeping procedures at the facility level, including sample forms, trend logs, or others, and a rationale for each.

4. Maintenance procedures, schedules and recommendations.

5. Ongoing Optimization

O. Post Occupancy Review

1. The CxA will return to the site within the 12-month warranty period to address the following: review current building operations with facility staff and address outstanding issues related to the Owner's Project Requirements; interview facility staff and identify problems or concerns with operating the building; identify problems covered under warranty or under the original construction contract.

2. The CxA will make suggestions for improvements in the content of the O&M Manuals. Any required changes shall be made by the contractor responsible for that section.

3. The CxA shall assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

P. Commissioning Final Report

1. The CxA shall provide a final report following the completion of all Functional Performance Testing. The report is to outline compliance and non-compliance to the construction documents, as well as identify concerns relative to future performance.

3.7 GENERAL TESTING REQUIREMENTS

A. Pre-functional checklists are important to ensure that the equipment and systems are installed and operational. They ensure that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system. The Commissioning Agent shall complete the pre-functional checks in the field, with assistance from the installing Contractors (where necessary).

B. The installing contractors, under the direction of the CxA, shall perform Functional Performance Testing of systems and sub-system performance after Pre-Functional checks have been completed and all outstanding issues resolved.

C. The installing contractor will perform tests specified in Division 1 commissioning process activity sections, and other sections specifying approved testing procedures.

1. Verify and test performance using actual conditions whenever possible.

2. Simulate conditions by imposing an artificial load when it is not practical to test under actual conditions. Set and document simulated conditions and methods of simulation. After test, return settings to normal operating conditions.

3. Alter set points when simulating conditions is not practical.

D. The CxA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractors for review and comment.

E. Deficiencies/Non-Conformance

1. The CxA will record the results of the functional test on the test form. All deficiencies or non-conformance items shall be noted and reported to the Owner, lead Consultant, and Contractors.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA.

3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.

4. As tests progress and a deficiency is identified, the CxA discusses the issue with the executing contractor.

5. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it, the CxA documents the deficiency and the contractor's response and intentions or corrections. The CxA and contractor then proceed to another test or sequence. Once the contractor corrects the deficiency, the test is rescheduled and repeated in the anticipation of correct operation or function. If a deficiency is identified, the cost of retesting will be as per section 3.7.

6. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible, the CxA documents the deficiency and the contractor's response. The deficiency is then forwarded to parties assumed to be responsible for the deficiency. Resolutions are made at the lowest management level possible. Other parties are brought into the discussion as needed. Final interpretive authority is with the AE. Final acceptance authority is with the Owner and CxA. The CxA will then document the resolution process. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency. The CxA then reschedules the test as stated in the section above. Costs of retesting are as stated below in the applicable section.

F. Cost of Retesting

1. The cost for the contractor to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM/GC.

2. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CxA will direct the retesting of the equipment once at no "charge" to the CM/GC for their time. However, the CxA's and owner's time for a second retest will be charged to the CM/GC, who may choose to recover costs from the responsible contractor or subcontractor. Before retesting occurs, the CM/GC will inspect the deficiency and respond to the CxA that the issue has been addressed.

3. The time for the CxA and owner to direct any retesting required because a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the CM/GC, who may choose to recover costs from the party responsible for misinformation or deficiency.

4. The contractor shall respond in writing to the CxA and Owner at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

5. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the CM/GC, contractors or subcontractors.

G. Failure due to Manufacturer Defect

1. If 10% or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM/GC, CxA or Owner. In such case, the Contractor shall provide the Owner with the following:

   a. Within one week of notification from the CM/GC or Owner, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM/GC or Owner within two weeks of the original notice.

   b. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

2. The CM/GC, CxA or Owner will determine whether a replacement of all identical units or a repair is acceptable.

3. Two examples of the proposed solution will be installed by the Contractor and the Contractor will be allowed to test the installations for up to one week, upon which the CxA or owner will decide whether to accept the solution.

4. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

H. Approval

1. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA. The CxA recommends acceptance of each test to the Owner using a standard form.

I. Deferred Testing

1. Unforeseen Deferred Testing – If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Owner. These tests will be conducted in the same manner as the seasonal tests, as soon as possible. Services of necessary parties will be negotiated.

2. Seasonal Testing - During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate contractors, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and record documents due to seasonal testing will be made by the contractor.

3.8 SYSTEMS TO BE COMMISSIONED

A. Refer to individual sections listed in Section 1.2 – SUMMARY for specific systems to be commissioned.

3.9 OPERATION AND MAINTENANCE MANUALS

A. The specific content and format requirements for the standard O&M manuals are detailed in Division 01. Special requirements for the controls contractor and TAB contractor are found in Division 23.

B. AE Contribution – The AE will include in the beginning of the O&M manuals a separate section describing the systems including the Basis of Design prepared by the AE. They will also provide Simplified professionally drawn single line system diagrams on 8 ½" x 11" or 11" x 17" sheets. These shall include (ex. chillers/hot water system(s), condenser water system, supply air systems, exhaust systems, etc.). These shall show major pieces of equipment such as (ex. pumps, chillers, heat exchangers, control valves, expansion tanks, coils, service valves, etc.).

C. CxA Review and Approval - Prior to substantial completion, the CxA shall review the O&M manuals, documentation and record documents for systems that were commissioned to verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the CM/GC, Owner or AE, as requested. Upon successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the CM/GC, Owner or AE. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the AE's review of the O&M manuals according to the AE's contract.

3.10 TRAINING OF OWNER PERSONNEL

A. The CM/GC and contractors shall be responsible for training coordination, scheduling and ultimately for ensuring that training is completed.

B. The CxA shall oversee the training of Owner's personnel for commissioned equipment and systems.

1. The CxA shall interview the Owner's staff to determine the special needs and areas where training will be most valuable. The Owner and CxA shall decide how rigorous the training should be for each piece of commissioned equipment. The CxA shall communicate the results to the CM/GC and contractors. Who will in turn communicate to the Subcontractors and vendors who also have training responsibilities.

2. In addition to these general requirements, the specific training requirements of Owner personnel by contractors, subcontractors and vendors is specified in the individual sections listed in Section 1.2 – SUMMARY.

3. Each Sub and vendor responsible for training will submit a written training plan to the CM/GC and/or contractors for review and approval prior to training. The CM/GC and/or contractors will submit one comprehensive training plan to the CxA and Owner.

4. The plan will be reviewed by the CxA and Owner. Comments pertaining to its deficiencies will be forwarded to the CM/GC and Contractors. The training plan will be rewritten until approved by the CxA and Owner. The final approved training plan will cover the following elements:

a. Equipment (included in training)

b. Intended audience

c. Location of training

d. Objectives

e. Subjects covered (description, duration of discussion, special methods, etc.)

f. Duration of training on each subject

g. Qualified instructor for each subject

h. Instructor qualifications

i. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

5. For the primary HVAC equipment, the Controls Subcontractor shall provide a discussion of the control of the equipment during the mechanical or electrical training conducted by each Subcontractor or vendor.

6. Training documentation shall include the following items:

a. Copy of the training plan, including schedule, syllabus, and agenda.

b. Copy of the Owner's Program Requirements.

c. Copy of the Basis of Design.

d. Compiled operations manuals.

e. Compiled maintenance manuals.

f. Completed manufacturer training manuals.

g. Red-lined drawings.

h. Other pertinent documents.

7. The CxA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CxA recommends approval of the training to the Owner using a standard form. The owner signs the approval form/letter template.

8. At one of the training sessions, the CxA provides a presentation discussing the use of the blank functional test forms for re-commissioning equipment

9. Recording of the training sessions in will be provided by the CM/GC, with recordings documented by the CM/GC and added to the O&M manuals, if required by Division 1 specifications.

10. The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be one to two hours in length and include a review of mechanical systems using the simplified system schematics (one-line drawings).

3.11 REPORTING

A. The CxA will provide regular reports to the Owner, on a pre-determined frequency in accordance with the project schedule. The CxA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

B. The CxA will keep all documentation and log all commissioning-related issues that require current or future attention including deficiencies. An agreed-upon form will track the status of documentation and testing for each piece of equipment and system.

3.12 COMMISSIONING DOCUMENTATION

A. The CxA oversees and maintains the development of commissioning documentation. The commissioning documentation shall be kept electronically and organized by system and sub-system when practical. All pages shall be numbered, and a table of contents page(s) shall be provided. The commissioning documentation shall include, but not be limited to, the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for systems, assemblies, equipment, and components to be verified and tested.

4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.

5. Certificate of readiness certifying that systems, subsystems, equipment, and associated controls are ready for testing.

6. Test and inspection reports and certificates.

7. Corrective action documents.

8. Verification of testing, adjusting, and balancing reports.

9. Approved final test and balance report for the building being commissioned.

10. All accepted shop drawings of systems equipment.

11. All pre-functional performance test checklists, signed by personnel performing and/or witnessing test, organized by system and sub-system.

12. All verification and functional performance test checklists/results, signed by personnel performing and/or witnessing test, organized by system and sub-system. This information may be used for calibrating the original energy simulation model. The revised model will be used to create the baseline for energy use in the building.

*****END OF SECTION 01 91 00*****

SECTION 01 91 15 BUILDING ENCLOSURE COMMISSIONING REQUIREMENTS

1.0 GENERAL

1.1 SECTION INCLUDES

A. This section includes the commissioning requirements for the Building Enclosure systems.

1. The commissioning requirements for the Building Enclosure systems given in this section are entirely separate from, and in addition to, the General Commissioning Requirements for this project. The General Contractor (GC), Subcontractors, and Suppliers are required to participate in both commissioning processes as required and any supplemental General Commissioning requirements.

2. The Commissioning Agent and Building Enclosure Commissioning Agent will provide separate documentation for each commissioning process.

1.2 GENERAL DESCRIPTION

A. Building Enclosure Commissioning (BECx) is a systematic process of ensuring all building enclosure systems responsible for environmental separation perform interactively according to the Owner's Project Requirements and the Architect's Basis of Design. The BECx process is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify and document proper installation and performance of building enclosure materials and systems.

2. Provide Owner with functional building enclosure systems that meet the Owner's Project Requirements.

B. Commissioning does not take away from, or reduce responsibility of, system designers or installing contractors to provide a finished and fully functioning product.

C. This section shall in no way diminish the responsibility of Division 03, 04, 07, 08, and 09 Contractors, Subcontractors, and Suppliers in performing all aspects of work and testing as outlined in the Contract Documents. Any requirements outlined in this section are in addition to requirements outlined in Division 03, 04, 07, 08, and 09.

1.3 RELATED WORK AND DOCUMENTS

A. Specific building enclosure commissioning requirements are provided in this specification. The following specification sections are related to the commissioning work specified in this section:

1. General Commissioning Requirements: Refer to 019100

2. Building Enclosure Benchmark and Functional Performance Testing

3. Basic Concrete Requirements: Refer to Division 03

4. Basic Masonry Requirements: Refer to Division 04

5. Basic Waterproofing, Sealants, Expansion Control, Metal Wall Panels, Roofing, Air Barrier and Insulation Requirements: Refer to Division 07

6. Basic Fenestrations Requirements: Refer to Division 08

7. Basic Finishing Requirements: Refer to Division 09

1.4 ABBREVIATIONS

A. The following are common abbreviations used in the Specifications (definitions are found further in this Section):

1. A/E - Architect and Design Engineers

2. BECA - Building Enclosure Commissioning Agent

3. CxA - Commissioning Agent - Refer to Section 019100

4. GC - General Contractor

5. CT - Commissioning Team

6. Cx - Commissioning

7. Cx Plan - Commissioning Plan

8. FPT - Functional Performance Test

9. OR - Owner's Representative

10. O&M - Operations & Maintenance

11. OPR - Owner’s Program Requirements

12. RFI - Request for Information

13. BETA - Building Enclosure Testing Agency

1.5 DEFINITIONS

A. Approval: Acceptance that a material or system has been properly installed and is functioning in tested modes according to the Contract Documents.

B. Architect/Engineer (A/E): Prime consultant (architect) and sub-consultants who comprise the design team, generally the Architect of Record and any Design Sub-consultants.

C. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to meet the OPR.

D. Building Enclosure Commissioning Agent (BECA): Contracted through the Owner. The BECA directs and coordinates day-to-day building enclosure commissioning activities independently from CxA and reports directly to the Owner.

E. Commissioning Agent (CxA): Contracted to Owner. CxA directs and coordinates day-to-day commissioning activities excluding BECx activities. CxA reports directly to Owner.

F. Commissioning Plan: Overall plan developed after bidding that provides structure, schedule, and coordination planning for commissioning process. The BECx plan will be provided separately from other Cx plans.

G. Contract Documents: Documents binding on parties involved in construction of this project (drawings, specifications, change orders, amendments, contracts, etc.).

H. Deficiency: Condition of a building enclosure material or system that is not in compliance with Contract Documents, i.e. does not perform properly or is not complying with design intent.

I. Functional Performance Test (FPT): Test of installed (either mock-up or field) performance of building enclosure materials and systems. Systems are tested under various simulated environmental conditions.

J. Owner's Project Requirements (OPR): A written document that details the functional requirements of a project and the usage and operational expectations. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

K. Simulated Condition: Condition created for testing component or system (e.g., applying pressure differential across the building enclosure concurrent with water spray to simulate a wind-driven rain).

L. Specifications: Construction specifications of Contract Documents.

M. Mock-up: The activities where systems or materials are initially constructed and tested. Mock-ups are to be free standing and approved prior to commencing full-scale construction.

N. Benchmark installation: the first completed area for each type of installation that is inspected visually and technically, and approved by the a/e and façade consultant. It constitutes a benchmark against which all future work is assessed.

O. Subcontractor: Contractors of GC, and their Subcontractors, who provide and install building enclosure components and systems.

1.6 COORDINATION

A. Commissioning Team: Members of the Commissioning Team (CT) will consist of:

1. Commissioning Agent (CxA)

2. Building Enclosure Commissioning Agent (BECA)

3. Building Enclosure Testing Agent (BETA)

4. Cornell Owner's Representative(s) (OR)

5. General Contractor (GC)

6. Architect and Design Engineers (A/E)

7. Building Enclosure Subcontractors

B. Management: Owner will contract services of the BECA directly. The BECA will direct and coordinate commissioning activities and report to the OR. All members of the Commissioning Team shall cooperate to fulfill contracted responsibilities and objectives of the Contract Documents.

C. Scheduling:

1. BECA will work with commissioning team to establish required commissioning activities to incorporate in preliminary commissioning schedule. The GC will integrate commissioning activities into master construction schedule. Necessary notifications are to be made in a timely manner in order to expedite commissioning.

1.7 SUBMITTALS

A. A/E or General Contractor shall provide BECA with documentation required for commissioning work. At minimum, documentation shall include: General Commissioning Requirements and performance data and any performance test procedures.

B. BECA shall review submittals concurrent with the A/E for conformance as it relates to Building Commissioning.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 SYSTEMS TO BE COMMISSIONED

A. Building Enclosure

1. Below Grade Systems, Roofing Systems, Opaque Wall/Cladding Systems, Air Barrier Systems, Fenestration Systems responsible for providing the following functions:

   a. Air barrier

   b. Vapor barrier

   c. Insulation

   d. Waterproofing

3.2 RESPONSIBILITIES OF COMMISSIONING TEAM DURING CONSTRUCTION

A. Architect/Engineer (A/E)

1. Document design intent of systems.

2. Review and incorporate building enclosure commissioning specification and functional performance test specification into the construction documents.

3. Provide construction documents electronically.

4. Review BECA comments on construction document and shop drawings.

5. Assist in dispute resolution regarding building enclosure items.

6. Review BECA reports.

B. Building Enclosure Commissioning Agent (BECA)

1. Review and comment on the Design Intent and Basis of Design for the project, and create the Owner's Project Requirements (OPR) document for the building enclosure after the initial kick-off meeting with the project team.

2. Develop and submit the Building Envelope Commissioning Plan, coordinating the Plan with the CxA and the rest of the team.

3. Develop Enclosure Commissioning specifications and requirements for Functional Performance Testing for building envelope systems for incorporation into the project documents.

4. Develop and maintain an Enclosure Design Issues Log, documenting identified issues, responses, and resolution.

5. Attend regularly scheduled meetings/conference calls/web-based interfaces at milestones appropriate for the complexity of the project and to maintain schedule milestones.

6. Provide technical reviews of the 100% Construction Documents.

7. Review all exterior envelope subcontractor proposals, evaluate qualifications and exclusions, and make recommendations.

8. Conduct a BECx kick-off meeting with the Owner, Design Team, Construction Manager, and Subcontractors, including preparing meeting minutes.

9. Review the construction sequencing and verify the material assembly and compatibility through shop drawings and project submittals. Review of the shop drawings and submittals pertinent to the building enclosure will be conducted prior to or in conjunction with the review by the Design Team. The Design Team will have the ability to incorporate review comments for approval.

10. Review and comment on all enclosure related RFIs, bulletins, and change order proposals.

11. Review proposed substitutions and value engineering.

12. Review and comment on construction scheduling and sequencing.

13. Lead a pre-installation conference for building enclosure trades and issue meeting minutes to the project team. During the meeting, review trade sequencing, ownership, constructability, and compatibility of work.

14. Review and document the construction of an initial benchmark installation against the design documents, shop drawings, recommended manufacturer's installation instructions, and the industry accepted standard of care. All testing will be witnessed and documented, and assistance provided for diagnosing performance problems. At the completion of the initial benchmark installation, notes, photos, sketches, manufacturer's details, project information and design changes will be assembled into an initial benchmark installation manual that will be distributed to the project team. This manual is intended to define the standard of care demonstrated in the initial benchmark installation for use on the remainder of the project.

15. Verify and document field QA/QC tasks, perform weekly inspections, and track the progress of resolving on-going deficiency list items. During QA inspections, review the exterior enclosure for conformance to the design documents, shop drawings, recommended manufacturer's installation instructions, and the industry accepted standard of care. Reporting system shall individually track each condition observed in the field with the intent of completing this project with no unaddressed items. Verify that the enclosure checklists are being utilized and tracked.

16. Update the BECx plan throughout the construction phase, as required. Integrate RFIs and change orders into the BECx plan and coordinate BECx plan items with relevant parties.

17. Observe and witness functional performance testing and retesting by others. Prepare and distribute written and illustrated reports to the project team including concerns and recommendations.

18. Prepare a draft and final commissioning report of all work and final acceptance.

19. Review as-built drawings and O&M manuals.

20. Visit the site approximately 11 months post occupancy to review the performance and observe the condition of the exterior building elements. Upon completion of this site visit, update the final commissioning report.

C. General Contractor (GC)

1. Attend all commissioning meetings.

2. Incorporate commissioning activities into the construction schedule.

3. Periodically update commissioning activities in the construction schedule.

4. Facilitate cooperation of Subcontractors in commissioning work.

5. Submit copies of initial and final A/E approved submittals for commissioned system equipment to BECA for review.

6. Review BECA submittal comments

7. Verify building enclosure materials and assemblies are ready for functional testing.

8. Submit maintenance logs of all interim maintenance or repair tasks performed by Subcontractors.

9. Ensure resolution of non-compliance and deficiencies in construction or test results. Obtain written documentation of completion from the appropriate Subcontractors.

10. Provide letters of compatibility for adjacent building enclosure materials and assemblies.

11. Facilitate all repairs and retesting of failed condition and pay for all associated costs.

12. Provide all warrantee information to BECA.

D. Subcontractors/Vendors

1. Review Commissioning Plan and FPT specification.

2. Attend commissioning kick-off meeting and other commissioning team meetings.

3. Notify GC and BECA of work completion.

4. Attend all required material and systems testing.

5. Execute all periodic maintenance or repairs required on started systems from initial benchmark installation to final acceptance by Owner to prevent material warranties from being voided.

6. Ensure installation work is complete, is in compliance with Contract Documents, and is ready for Functional Performance Testing. Notify GC that equipment and systems are ready for Functional Performance Testing. FPT test results will be documented by BECA.

7. Provide all warranty information to GC.

E. Building Enclosure Testing Agency (BETA)

1. Attend commissioning kick-off meeting and other commissioning team meetings.

2. Provide on-site technician and equipment to complete benchmark and field Functional Performance Testing.

3. Prepare and submit reports at the conclusion of all testing.

4. Perform retesting and prepare corresponding reports.

3.3 REPORTING

A. BECA will provide status reports to GC, A/E, and Owner as needed.

B. BECA shall submit non-compliance and deficiency reports to GC, A/E, and Owner as needed.

C. BECA shall provide a final summary report to Owner.

3.4 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation

1. BECA will witness and document results of FPT.

B. Non-Conformance

1. BECA will record results of functional testing. Deficiency or non-conformance issues will be noted and reported to GC, CxA, and Owner.

2. Corrections of minor deficiencies identified may be made during tests at discretion of BECA. In such cases, deficiency and resolution will be documented.

3. Every effort will be made to expedite testing and minimize unnecessary delays, while not compromising integrity of tests. BECA shall not overlook deficient work or loosen acceptance criteria to satisfy scheduling or cost issues unless directed to do so by the Owner.

4. Deficiencies are handled in the following manner:

   a. When there is no dispute on deficiency and Subcontractor accepts responsibility for remedial action:

      - BECA documents deficiency and Subcontractors response and intentions and they go on to another test or installation. BECA submits deficiency report to GC, CxA, and Owner. Copy is provided to Subcontractor by GC. Subcontractor corrects deficiency and certifies that material or assembly is ready to be retested. GC informs CT of retesting schedule.
      - GC reschedules test with BECA and BETA.

   b. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

      - BECA documents deficiency and Contractor's response. BECA submits deficiency report to GC, CxA, and Owner. A copy is provided to Subcontractor by GC.
      - GC facilitates resolution of deficiency. Other parties are brought into discussions as needed. Final interpretive authority is with A/E. Final acceptance authority is with the Owner.
      - GC documents resolution process.
      - Once interpretation and resolution has been decided, appropriate party corrects deficiency, GC reschedules test, and test is repeated until satisfactory performance is achieved.

C. Cost of Retesting

1. Costs for all retesting will be the full responsibility of the GC and Subcontractors. These costs include all access, equipment, labor, and materials required to complete the retesting.

3.5 COMMISSIONING DOCUMENTATION

A. Final Report Details

1. Final commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, and general description of testing and verification methods. Report will contain evaluation regarding:

   a. Conformance to specifications and design intent

   b. Material/system installation

   c. Functional performance

2. All outstanding non-compliance items will be specifically listed.

3. Recommendations for improvement to system or operations, future actions, etc. will also be listed.

*****END OF SECTION 01 91 15*****

SECTION 01 95 00 BIM COORDINATION

1.0 GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of the Section of the Specifications.

1.2 SUMMARY

A. The Contractor shall direct the creation of a computer-based building information model (BIM) create by the following trades for the BIM Coordination process:

1. Structural Steel
2. Concrete
3. HVAC
4. Electrical (including communications and security as applicable)
5. Plumbing
6. Fire Protection

B. The Contractor shall review and verify the model. Owner will provide a base model.

C. All relevant models will be incorporated into one review file for use during coordination meetings. The Coordination Team shall utilize NavisWorks clash detection software to expedite the drawing review process and resolution. Subcontractor models must be submitted in a model format that is compatible with NavisWorks.

1.3 DEFINITIONS

A. Coordination Team: Contractor and Subcontractors.

B. 3D Coordination Model: Electronic 3D geometric representation combining all trades involved in the coordination process.

C. 3D Subcontractor Model: Electronic 3D geometric representation of the trade specific building elements to be installed for a specific contractor's scope of work.

D. Virtual Design and Construction (VDC) Modeling Manager: Contractor appointed personnel responsible for working with the model and for guiding the 3D coordination process.

E. Subcontractor BIM Production Modeler: Subcontractor personnel responsible for working with the model and for interpreting the information provided within the model.

F. Clash Detection Software: NavisWorks Manage 2011 minimum, or other version as determined by the Contractor.

1.4 SUBMITTALS

A. Contractor's Coordination Model: The coordination model will be reconciled by each Subcontractor to find the best collective solution to the coordination of all items.

1. Each Subcontractor will supply a 3D Subcontractor Model for their own scope of work separated by areas as directed by Contractor.

2. Each Subcontractor will be responsible for working in harmony with the other Subcontractors to resolve coordination issues.

3. Subcontractor models will be color coded to provide delineation between systems.

4. 2D coordination drawings will still be required as directed by Contractor and required for shop drawing approvals.

1.5 SCHEDULE

A. Time is of the essence on this project. Contractor is responsible for all efforts, methods, procedures and costs required to meet or better the scheduled dates. If, at any time, it is determined by the Contractor, or the Subcontractor, that they are not on schedule for any reason within the control or responsibility of the Contractor, the Contractor shall increase its manpower or work such overtime as is required to bring the Work back within the Project Schedule. Such additional efforts shall be performed at no additional cost to the Owner.

B. The proposed schedule includes "estimated" start dates for the construction activities. In the interest of the Project, the Contractor reserves the right to alter the sequencing of activities in order to accommodate the project conditions or Owner requirements. It is understood that the Contractor shall be obligated to complete its activities within the specified durations regardless of the actual start date. Contractor agrees to meet or better each duration.

2.0 PRODUCTS

2.1 MODELS

A. 3D Subcontractor Model – computer generated 3D drawings used for coordination, conflict resolution, fabrication, and as-built documentation.

1. Each Subcontractor will be responsible for producing a model/models to represent the Work of the Subcontractor in accordance with the work breakdown structure to be provided by the Contractor.

2. If the Subcontractor does not have the in-house capability to produce the required model/models, the Contractor may utilize the service of an outside entity to provide this service. The Subcontractor shall, within seven (7) business days of being identified as the approved low bidder, provide to the Contractor and Consultant the name, qualifications and experience history of the proposed BIM Production Modeler. The BIM Production Modeler shall have experience on projects of similar size, scope and complexity. The Contractor has the right to approve any proposed BIM Production Modeler. If the BIM Production Modeler proposed is not approved by the Contractor, then the Subcontractor shall identify another firm acceptable to the Contractor without any change in cost.

3. All elements must be drawn to scale and shall be a true representation of what is to be installed in the field in all three dimensions.

4. File origin or project insertion point (x,y,z) shall be agreed upon by the project team. Any conflicts that arise due to non-adherence with the insertion point shall be the responsibility of the non-compliant Subcontractor.

5. The file naming convention shall be broken down as follows: trade_level_date:

6. Example “MS_FLR1_070109.dwg” where “MS” designates the mechanical trade contractor, “FLR1” is the building level, and “070109” indicates the date the file is posted.

7. Model coordination files will be saved to the project on the ePM system for access by all trades, Contractor and the Owner’s Representative. The folder structure will contain a “Current Model” file folder and an “Old Model” file folder. It will be the Subcontractor’s responsibility to maintain the appropriate models in the correct file at all times.

8. When an update to a model has been posted each Subcontractor shall issue a notification via email to each of the other coordination team members notifying them that new information is available. Email, however, shall not be the primary method of delivering model or drawing updates.

9. Working units, unless otherwise specified, shall be in inches.

10. All trades must use a separate color as agreed upon. Colors and/or textures per standards shall be provided by the Contractor VDC Modeling Manager.

11. Each Subcontractor shall maintain their own model files as sole author. Subcontractors are responsible for providing the team with NavisWorks compatible files for their scope of work which will be used for coordination. In some cases separate files will be requested for specific systems within a trade in order to provide the Contractor with greater functionality in the record model.

12. In the event the design changes are issued by bulletin which will result in changes in the model/models, it is the responsibility of the Subcontractor to make any and all changes required for coordination and compliance with the design. The Subcontractor may include the cost of modeling and coordination if warranted into their request for change authorization.

13. Subcontractors will grant the Contractor a perpetual, fully paid license to use the models produced by this agreement.

A. Ownership:

1. The CADD files, AutoCAD architecture files, TIF files, shop drawings, RFI's, as-built drawings, etc. (collectively "Project Information"): The Subcontractor agrees it will keep all project information in strict confidence and will not use on any other project or for any other reason. The Subcontractor further agrees it will not disseminate the project information to anyone except with a need to know.

3.0 EXECUTION

3.1 MODEL COORDINATION PROCESS

A. Coordination Meetings

1. Each Subcontractor is required to take part in regular coordination review meetings. The time and place for these meetings will be established by Contractor.

2. Contractor shall include Owner and Architect in all coordination meetings and coordinate level of participation as needed for coordination. BIM Coordination updates shall be part of in each job-meeting

3. The purpose of the coordination meeting is to identify and resolve probable interferences between building systems.

4. Subcontractors shall supply a Subcontractor Modeling Manager or person authorized to act and make decisions on behalf of their organization.

5. If conflicts are identified and a resolution is agreed upon it is the Subcontractor's responsibility to have the necessary changes made in their model and republish said model to the project intranet site in time for the next meeting unless another timeframe is agreed upon.

B. Coordination Process

1. Step 1: Subcontractors to identify conflicts between their system model and the base model and resolve with the Contractor and design team prior to MEP coordination meeting.

2. Step 2: Subcontractors to identify any required penetrations in architectural and structural elements for their work prior to MEP coordination meeting.

3. Step 3: Subcontractors to provide system model to the Contractor. Contractor will integrate system model with base model in NavisWorks to create a "coordination model".

4. Step 4: Subcontractors and the Contractor to meet, review, and resolve clashes/conflicts within the coordination model.

5. Step 5: Subcontractors make changes to their system model per resolutions from MEP coordination meeting.

6. Step 6: Repeat steps 3 through 5 until all clashes/conflicts have been resolved in the coordination model.

C. Equipment Models: All equipment specified and intended to be used for installation shall be represented in the coordination model as a fully functional 3D component with the following characteristics:

1. Create models in a software application capable of embedding all information specific to that equipment which would typically be available in the required shop drawings and submittals.

2. Construct the models to accurately identify all of the physical components including:

   a. Length, width and height of equipment.

   b. Weight of equipment.

   c. Accurate location of all facility connection points.

   d. Proper identification of required supports whether provided by the Subcontractor or others.

   e. Access for maintenance and/or filter changes locations.

   f. Clearances required for proper ventilation and/or maintenance.

   g. OSHA clearances.

3. Include all clearance requirements for the equipment as outlined by the equipment manufacturer and all applicable building codes. Identify clearances on a specific layer that can be turned off for coordination purposes. Identify clearances as solid planes ("no fly zones") which will register as clashes during the coordination effort.

4. Provide equipment model information to the Contractor in its native (*.dwg) format as well as the International Foundation Class (IFC) format (IFC format describes the behavior, relationship, and identity of a component object within a model).

D. Record Information

1. Upon completion of coordination activities for a floor area as deemed appropriate by Contractor, a 2D drawing or series of drawings representing the floor or area will be printed for review by the Contractor and all members participating in the coordination. This will become the record coordination document.

2. Subcontractors shall maintain their models during construction to match the 'as-built' condition of their installed work.

3. The Subcontractor will deliver to the Contractor, at the completion of the project, a record construction model in NavisWorks that incorporates all of the trade models, fabrication models and updated design models. The native files from each trade shall also be provided. In addition, the Subcontractor will deliver to the Contractor, an updated NavisWorks model.

E. Change Conditions

1. In that design changes are issued by bulletin, Construction Change Directive (CCD) or other method the applicable Subcontractors will make the changes required in their model/models to support the coordination process without delay.

3.2 3D MODELING

A. Order of Modeling:

1. Unless otherwise noted in the bid packages and trade contractor agreement, the sheet metal contractor shall publish a base model with the major trunk lines which will serve as the basis for the other trades to begin their individual models.

B. Stratification:

1. Each Subcontractor will be assigned specific work zone elevations (top and bottom) to run racks and mains. The assigned trades will take precedence in these areas, when traveling outside of these areas the following order of importance rules apply. Additional rules may be instituted at the first coordination meeting.

a. Immovable objects (equipment pads, hoods, shafts).

b. Graded piping routed throughout floors (waste, storm drainage, high purity).

c. Item coordinated with structure (duct penetrations shown on structural).

d. Items located in their designated area (piping zone, pipe rack, cable tray).

e. Items that require access (VAV's, shut off valves, fire/smoke dampers, and similar items).

C. System Models and Level of Detail:

1. The level of detail defined in each section below (Modeling Standards) is the minimum level of detail required in the model. Greater detail than the minimum should be incorporated in the model whenever inclusion of such detail will improve spatial or sequencing coordination of the Work.

2. To the extent that location can be determined from the construction documents, the model will reflect that location. The intent of this model is to show the ductwork and piping, and similar items in as true representation of the actual condition at construction completion.

3. Pre-purchased equipment shall be the responsibility of the Subcontractor assigned to receive, install and coordinate the equipment, and they shall be fully responsible for layout, 3D drawings and coordination of the pre-purchased equipment.

4. Each Subcontractor is responsible for modeling protected access zones. Access zones should be drawn at 60% shading as not to obscure the main fixture or element being protected, or shall have another similar identifying characteristic.

5. Individual model elements (such as VAV boxes, pumps, and similar items) described in further detail below shall each contain the specific and individual name assigned to it as per the design documents, following the approved naming conventions established by the Contractor's VDC.

D. Modeling Standards:

1. HVAC Sheet Metal Standards

a. All ducts, related accessories (including but not limited to standard dampers, fire dampers, VAV boxes, diffusers, turning vanes, etc.) and HVAC equipment will be modeled.

b. Ducts will be modeled to the outside face dimension of duct or duct insulation. Hangers must be modeled where necessary to coordinate with the work of other trades.

c. Access zones shall be modeled for all elements requiring access including but not limited to equipment, fixtures, standard dampers, fire dampers, VAV boxes, diffusers, turning vanes, and similar items.

d. All equipment shall be modeled to its overall height, width and depth.

e. All access panels shall be modeled, including access zones above and below.

f. In the event that seismic bracing for suspended elements is required by code, such bracing shall be included in the model.

2. HVAC Piping Standards

    a. All piping, related accessories (valves, air vents, drain valves, flow meters, etc.) and HVAC equipment will be modeled.

    b. Pipes will be modeled to the outside diameter of the pipe or pipe insulation. Hangers must be modeled where necessary to coordinate with the work of other trades.

    c. Equipment will be modeled to its overall height, width and depth.

    d. Access zones shall be modeled for all elements requiring access including but not limited to equipment, fixtures and valves.

    e. All access panels shall be modeled, including access zones above and below.

    f. In the event that seismic bracing for suspended elements is required by code, such bracing shall be included in the model.

3. Plumbing and Specialty Piping Standards

    a. All plumbing, specialty piping, related accessories (valves, air vents, drain valves, flow meters etc.) and equipment will be modeled (piping 1-1/2" diameter or larger). Process piping 2" diameter or larger shall be modeled.

    b. Pipes will be modeled to the outside diameter of the pipe or the pipe insulation. Pipe slope will be incorporated in the model. Hangers must be modeled where necessary to coordinate with the work of other trades.

    c. Equipment will be modeled to its overall height, width and depth.

    d. Access zones shall be modeled for all elements requiring access including but not limited to equipment, fixtures, valves and cleanouts.

    e. All access panels shall be modeled, including access zones above and below.

    f. In the event that seismic bracing for suspended elements is required by code, such bracing shall be included in the model.

4. Electrical Standards

    a. All conduit/MC cabling (1- 1/2" diameter and larger), power feeds to equipment, switch gear, panels, junction box and pull station locations will be modeled. Where groups of smaller conduit totaling 1- 1/2" diameter or larger are located, a graphic representation of the overall dimension of the grouped conduit may be substituted.

    b. Light fixtures with above-ceiling space requirements are to be included in the model and coordinated with reflected ceiling plan. All access zones or clearances to maintain light fixtures will also be modeled.

c. Equipment and cable tray with access zones to be included in the model along with unistrut supports. Equipment will be modeled to its overall height, width and depth.

d. Equipment and junction box access zones per specification and code (whichever is greater) shall be modeled.

e. All access panels shall be modeled, including access zones above and below.

f. In the event that seismic bracing for suspended elements is required by code, such bracing shall be included in the model.

5. Fire Protection (Sprinkler, Fire Alarm)

a. All components of the fire protection system will be modeled.

b. Access zones shall be modeled for all elements requiring access including but not limited to equipment, fixtures, valves and controllers.

c. Locate all piping, valves, fire pump, sprinkler heads, heat and smoke detectors.

d. All access panels shall be modeled, including access zones above and below.

e. In the event that seismic bracing for suspended elements is required by code, such bracing shall be included in the model.

6. Concrete

a. All concrete shall be modeled.

7. Structural Steel

a. All structural steel shall be modeled, including but not limited to columns, beams, braces, gusset plates, connections, reinforcing plates and angles, pour stops, metal grating, seismic or secondary supports and beam penetrations.

b. The model elements shall contain non-graphic information that associates each element with its erection sequence as appropriate, and identifies the size of the structural element.

*****END OF SECTION 01 95 00*****

TECHNICAL SPECIFICATIONS

FOR

RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE – PHASE 2

CORNELL UNIVERSITY
ITHACA, NEW YORK

CORNELL UNIVERSITY RENOVATE LIVESTOCK PAVILION FOR SURGE SPACE

Project Manual & Specifications

PHASE 2 BID DOCUMENTS
SUCF #161062
May 9, 2025

Owner
Cornell University
Ithaca, NY 14853

Architect
Architectural Resources
505 Franklin Street
Buffalo, NY 14202

Structural Engineer
Spring Line Design
73 Troy Road
East Greenbush, NY 12061

Landscape Architect
Fisher Associates
1001 West Seneca Street
Ithaca, NY 14850

Audio-Visual Systems
AVL Designs, Inc.
1788 Penfield Road
Penfield, NY 14526

Laboratory Planner
Jacobs
1 Penn Plaza, 10th Floor, Suite 1005
New York, NY 10119

MEP Engineer
M/E Engineering
300 Trolley Boulevard
Rochester, NY 14606

Building Envelope Specialist
Simpson, Gumpertz & Heger
800 Boylston Street, Suite 2320
Boston, MA 02199

Cost Estimator
Trophy Point
4588 South Park Avenue
Blasdell, NY 14219

Plumbing &
Fire Protection Engineer:

M/E Engineering
300 Trolley Boulevard
Rochester, NY 14606



Reg. Exp: 04/30/2026
Cert. of Auth: 0018443

05/09/2025
Date

Electrical Engineer:

M/E Engineering
300 Trolley Boulevard
Rochester, NY 14606



Reg. Exp: 04/30/2026
Cert. of Auth: 0018443

05/09/2025
Date

Landscape Architect:

Fisher Associates
1001 West Seneca Street
Ithaca, NY 14850



Reg Exp. 11/31/2026

05/09/2025
Date

END OF DOCUMENT 00 01 07

SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 017300 - Execution: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 070150.19 - Preparation for Re-Roofing: Removal of existing roofing, roof insulation, flashing, trim, and accessories.

G. Section 312000 - Earthwork: Rough and fine grading.

1.03 DEFINITIONS

A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.05 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Site Plan: Indicate:

1. Vegetation to be protected.
2. Areas for temporary construction and field offices.
3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.

1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
2. Summary of safety procedures.
3. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove paving and curbs required to accomplish new work.

B. Remove other items indicated, for salvage, relocation, recycling, and storage.

C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Use of explosives is not permitted.

3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
4. Provide, erect, and maintain temporary barriers and security devices.
5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
7. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
8. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements to remain in place and not removed.

1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

D. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on field observation, existing record documents and extension/installation of utilities as part of an earlier phase of this project..

1. Verify construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and required to accomplish new work.

1. Remove items indicated on drawings.

C. Services including, but not limited to, HVAC and Electrical: Remove existing systems and equipment as indicated.

D. Protect existing work to remain.

1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

4. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete formwork including:

   a. form-facing materials,
   b. Shoring, bracing, and anchoring

2. Concrete reinforcement including:

   a. Steel reinforcement bars.
   b. Welded-wire reinforcement.

3. Cast-in-place concrete including:
   a. Concrete materials.
   b. Mixture designs.
   c. Placement procedures.
   d. Finishes.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete Subcontractor.
   e. Special concrete finish Subcontractor.

2. Review the following:

    a. Special inspection and testing and inspecting agency procedures for field quality control.
    b. Construction joints, control joints, isolation joints, and joint-filler strips.
    c. Semirigid joint fillers.
    d. Vapor-retarder installation.
    e. Anchor rod and anchorage device installation tolerances.
    f. Cold and hot weather concreting procedures.
    g. Concrete finishes and finishing.
    h. Curing procedures.
    i. Forms and form-removal limitations.
    j. Shoring and reshoring procedures.
    k. Methods for achieving specified floor and slab flatness and levelness.
    l. Floor and slab flatness and levelness measurements.
    m. Concrete protection.
    n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
    o. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

5. Vapor retarders.
6. Curing materials. Submit a concrete curing plan as indicated below in section 1.5 (Information Submittals)
7. Joint fillers.
8. Repair materials.

B. Design Mixtures: Submit separate mix design not only for each compressive strength but also for:

1. Changes in air content (interior vs exterior slabs).
2. Changes in maximum aggregate size (slabs vs. poured pan stairs).
3. Inclusion of Moisture Vapor Reduction Admixture (MVRA), such as Vaporlock.

C. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

D. For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Slump limit.
4. Air content.
5. Nominal maximum aggregate size.
6. Include manufacturer's certification that MVRA or PRA are compatible with mix design.
7. Include certification that dosage rate for MVRA or PRA match dosage rate used in performance compliance test.
8. Intended placement method.
9. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Shop Drawings:

1. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

    a. Submit plans and elevations at 1/4” = 1’-0” scale for all wall areas including CMU walls.

2. Construction Joint Layout: Include proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval.

F. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
    a. A minimum of one finisher or finishing supervisor shall be currently certified as an ACI Flatwork Concrete Finisher when installing all exterior exposed concrete flatwork and interior exposed polished concrete flatwork. Contractor shall submit

ACI certification credentials (certificate or wallet card) of concrete finishers on the project. ACI credentials must be current and not expired.

2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Joint-filler strips.

C. Concrete curing plan. Flatwork shall be cured by 7 day non-contact wet cure.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

F. Preconstruction Test Reports: For each mix design.

1. All tests shall have been completed within the past 2 years.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel having a minimum of 5 years of documents experience with projects of similar scope and size. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency

laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Permeability when a MVRA or PRA are included.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Aggregate Reaction (AAR): Concrete shall be designed using strategies to reduce AAR. For example, AAR can be reduced by substituting 15% to 20% of cementitious material with class F fly ash conforming to ASTM C-618.

2. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

3. Maximum Coarse-Aggregate Size: See mix designs.
4. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
7. Moisture Vapor Reduction Admixture (MVRA): Concrete moisture vapor reduction admixture (MVRA) for use on all interior slabs unless noted otherwise. It shall be non-toxic and specifically designed to have a chemical reaction with pre-existing elements inside the concrete to reduce moisture vapor emission through the slab by restricting the integral capillary system. Chemical reaction shall form a permanent barrier (capillary break) that is integral to the concrete, insoluble, and irremovable.

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

      1) Specialty Products Group; Vapor Lock 20/20.
      2) Barrier One Concrete Admixtures; Barrier One MVRA-CPS.
      3) ISE Logik Industries, Inc.; MVRA 900.

   b. Dose at the minimum levels recommended by the approved manufacturer but not less than 10% of weight of cementitious materials.
   c. The inclusion of a MVRA shall not relive the requirement to provide a vapor barrier under slabs on grade.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

   a. Henry Company; Moistop Ultra 15.
   b. Raven Industries, Inc.; Vaporblock Series (VB15).
   c. Stego Industries, LLC; Stego Wrap Vapor Barrier (15-Mil).
   d. W. R. Meadows, Inc; Perminator 15 mil.

2.4 CURING MATERIALS

Flatwork shall be cured by 7-day non-contact wet cure. Curing compounds are not permitted for flatwork. See section 3.13 “Concrete Curing”.

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. Kaufman Products, Inc; VaporAid.
b. Master Builders Solutions; MasterKure ER 50.
c. SpecChem, LLC; Spec Film.
d. W. R. Meadows, Inc; EVAPRE.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, rolled sheet product consisting of an impermeable layer over an absorptive layer to hold moisture against the slab.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

a. PNA Construction Technologies Inc.; HydraCure.
b. Sika Corporation; UltraCure NCF.
c. Raven Industries; Conkure.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Euclid Chemical Company (The); an RPM company; Kurez DR VOX.
b. Kaufman Products, Inc; ThinFilm 420.
c. SpecChem, LLC; SpecRez.
d. W. R. Meadows, Inc; 1300-CLEAR.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219 and containing no gypsum-based materials.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 6000 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219 and containing no gypsum-based materials.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
2. All testing shall have been completed within the last two years.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: See mix designs.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.

E. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing and/or high-range water-reducing admixture in all concrete.
2. Use retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high-range water-reducing admixture in pumped concrete.
4. Use Moisture Vapor Reduction Admixture (MVRA) for all interior slabs unless noted otherwise, or to receive epoxy floor finish.

    a. MVRA shall be a non-toxic, liquid admixture that is free of all volatile organic compounds (VOC). It shall be specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through the slab by restricting the integral capillary system. Chemical reaction shall form a permanent barrier (capillary break) that is integral to the concrete, insoluble, and irremovable.

2.8 CONCRETE MIXTURES

A. Footings, and all other structural concrete construction unless noted otherwise: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Nominal maximum aggregate size: 1-1/2 inches.
3. Slump with a mid-range water reducer or a low dose of high-range water reducer or super plasticizer: 5 inches, plus or minus 1 inch.
4. Slump with a full dose of a high-range water reducer or super plasticizer: 7 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery.

B. Slabs-on-Grade (interior) and slabs on metal deck: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
1. Nominal maximum aggregate size: 1-inch.
    a. Use 1/2 inch max course aggregate for topping slabs and at poured-pan stairs.
2. Slump with a mid-range water reducer or a low dose of high-range water reducer or super plasticizer: 5 inches, plus or minus 1 inch.
3. Slump with a full dose of a high-range water reducer or super plasticizer: 7 inches, plus or minus 1 inch.

4. Air Content: Do not allow air content of interior trowel-finished floors to exceed 3 percent. Do not use an air entrainment admixture for this mix.
5. All interior concrete slabs shall contain a moisture vapor reduction admixture (MVRA), unless noted otherwise in the contract documents.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

1. Hot Temperature Mixing and Delivery:
   a. Air Temperature Between 85 and 90 deg F: Reduce mixing and delivery time from 90 minutes hours to 75 minutes.
   b. Air Temperature Above 90 deg F: Reduce mixing and delivery time to 60 minutes.
   c. Longer delivery times may be allowed with the use of a retarding admixture and when approved in writing from the Engineer of Record.

2.10 POST INSTALLED CONCRETE AND MASNRY ANCHORS

A. Expansion stud anchors: Hilti Kwik-Bolt III or Kwik-Bolt TZ, Hot-Dip Galvanized UNO, or approved equivalent.

B. Threaded rod stud anchors: Hilti HIT-HY 200 SafeSet Adhesive, OAE, or approved equivalent.

C. Threaded rod stud anchors in cold weather applications: Hilti HIT-ICE SafeSet Adhesive, OAE, or approved equivalent.

D. Threaded rod stud anchors in hollow and solid masonry: Hilti HIT-HY 270 Adhesive, OAE, or approved equivalent

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete where noted on the contract drawings.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Support all embedded items in advance of concrete placement. Do not “wet-stick” embedded items into plastic concrete.

3.5 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

3.6 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.

3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.7 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement prior to concrete placement. Do not “wet-stick” reinforcement into plastic concrete. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.8 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated on the Drawings. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form control joints with early entry power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete as soon as cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks, but not later than 8 hours after finishing.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
b. Remove projections larger than 1 inch.
c. Tie holes do not require patching.

d. Surface Tolerance: ACI 117 Class D.
e. Apply to concrete surfaces footings and other concrete surfaces not exposed to public view, unless noted otherwise.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

   a. Slabs on Ground:

      1) For slab areas less than 10,000 square feet, finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.
      2) For slab areas of 10,000 or greater square feet, provide overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17 for all other slabs unless noted otherwise.

   b. Suspended Slabs:

      1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.12 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors shall be cured by 7 day non-contact wet cure using one of the options below. Curing compounds are not permitted.

a. Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
1) Lap edges and ends of absorptive cover not less than 12 inches.
2) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

b. Moisture-Retaining-Cover Curing (wet curing blankets): Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
1) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
2) Cure for not less than seven days.

c. Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
1) Water.
2) Continuous water-fog spray.

3.14 TOLERANCES

A. Conform to ACI 117.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas only when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Photo document all areas to be patched prior to filling. Filling voids without proper documentation is cause for rejection of the patched area and replacement with new patches.
e. Fill and compact with patching mortar before bonding agent has dried.
f. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

a. Correct low and high areas.
b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 CONCRETE ANCHOR INSTALLATION

A. Identify location of embedded items such as reinforcing steel, stressing tendons, conduit, heating tubes, etc. prior to drilling holes. Coordinate with respective trades if any apparent conflict exists. Exercise care in coring and drilling to avoid damaging any existing embedded items. If embedded items are encountered, stop drilling and contact Engineer immediately. Any offsets or relocations of anchors must be approved by Engineer. This contractor is responsible for the cost of any required repairs including engineering costs.

B. Drill holes of proper diameter and depth in accordance with manufacturer's published design information for that specific anchor. Use only equipment approved by anchor manufacturer. All holes shall be perpendicular to the concrete surface unless shown otherwise on structural plans.

C. Do not drill holes until base material has achieved full design strength.

D. Installation of all post installed anchor products shall be conducted in strict accordance with the Manufacturer's Published Installation Instructions (MPII).Use hammer drills for adhesive anchors, or SafeSet drill for Hilti anchors (unless noted otherwise).

E. All adhesive anchor installations shall be conducted by a certified Adhesive Anchor Installer as certified by ACI/CSRI per ACI 318-11 D.9.2.2. Current AAI Certificated must be submitted to the Engineer of Record for approval prior to commencement of any adhesive anchor installations.

F. Clean out holes, properly prepare substrate, and install anchors in accordance with manufacturer's instructions. Proper tools must be on job site.

G. For adhesive anchors, maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Verify that base material temperature is within manufacturer limits. Do not install adhesive anchors if any criteria do not fall within manufacturer's limits. Ensure that bore holes and anchors are free of dust, standing water, ice, debris, grease, oil, dirt and other foreign matter.

H. For adhesive anchors, protect anchors with approved fire-resistive materials, or spray-on fireproofing when anchors are attached to fire-resistive construction. Refer to ICC-ES Evaluation Service Reports (ESR's) Conditions of Use for applicability.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating the following:

    1. Quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water withheld at the batch plant than may be added at Project site.

    2. Only automated computerized batch tickets are acceptable. Hand written batch tickets will not be accepted.

D. Inspections:

    1. Steel reinforcement placement.

        a. Note that reinforcement inspections must be completed a minimum of 2 hours prior to commencement of concrete placement.
        b. Concrete placed prior to complete reinforcement inspection and approval will be rejected.

    2. Headed bolts and studs.
    3. Verification of use of required design mixture.
    4. Concrete placement, including conveying and depositing.

5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.
7. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. Slump: ASTM C 143/C 143M; one test at point of truck discharge, for each truck delivery to the site, and for each composite sample. Perform additional tests when concrete consistency appears to change.
    b. Concrete with slump in excess of the specified maximum shall not be placed on the project.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure nine 4-inch by 8-inch cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of three laboratory-cured specimens at seven days and one set of three specimens at 28 days.
    b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test

value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.19 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 040300 - CONSERVATION TREATMENT FOR PERIOD MASONRY

PART 1 GENERAL

1.01 Section Includes

A. Cleaning of existing masonry surfaces.

B. Replacement of existing masonry units.

C. Repair of damaged existing masonry.

D. Raking and repointing of existing mortar joints.

1.02 Definitions

A. Aggregates: Sand component of mortar.

B. Biocide: Chemical treatment that inhibits, deters, or controls organic growth typically removed by cleaning following biocide treatment.

C. Binder: Component of mortar that binds aggregate particles into a cohesive material.

D. Dispersed Lime Crack Injection: Repair method in which dispersed lime material is injected using a needle or syringe into small cracks ranging in width from hairline to 1/8 inch (3.2 mm).

E. Consolidant: Chemical product to strengthen loose or deteriorated stone.

F. Dutchman: Repair method to partially remove deteriorated portion of stone and replace with salvaged or new stone.

G. In situ: Masonry units and mortar remain in place and are restored without removal.

H. Lime Wash: Protective surface treatment comprised of calcium hydroxide particles in suspension in water, along with small amounts of calcium carbonate, silica particles, and other minerals.

I. New Elements: New, nonhistoric materials added to masonry structures to aid in resistance to structural loads or water infiltration.

J. Patching: Use of substitute repair materials to treat damaged or deteriorated masonry units in situ.

K. Repointing: Removal of existing mortar joints to specified depth and replacement with mortar matching color, texture, and performance of original mortar, and with water vapor transmission, bond, hardness, and flexibility compatible with original mortar, tested in accordance with ASTM C1713.

L. Retooling: Chisel is used to recreate surrounding stone texture finish.

M. Surface Treatment: Application of traditional materials or contemporary chemical products to surface of masonry to provide protection to the masonry and mortar or reduce water infiltration.

N. Wall System: Masonry structures comprised of different materials but functioning holistically; restoration and cleaning processes should take into account effects on the adjacent materials and the building as a whole.

O. Saturated Surface Dry (SSD): Condition of masonry after application of water to soak into the capillary pores of the masonry, saturating an area of the masonry, reducing further suction, and allowing surface water to evaporate, leaving the substrate damp but without a surface film of water.

1.03 Reference Standards

A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

B. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

C. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

D. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.

E. ASTM C1713 - Standard Specification for Mortars for the Repair of Historic Masonry; 2023.

F. NPS (THP) - The Secretary of The Interior’s Standards For the Treatment of Historic Properties with Guidelines For Preserving, Rehabilitating, Restoring & Reconstructing Historic Buildings; 2017.

G. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 Administrative Requirements

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1. Require attendance of parties directly affecting work of this section.
2. Review installation conditions, procedures, and coordination with related work.

1.05 Submittals

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on cleaning compounds.

C. Samples: Submit four samples of face brick units to show matching color, texture, and extremes of color range.

D. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

E. Conservation treatment quality control plan.

F. Restorer's qualification statement.

G. Mortar testing agency qualification statement.

1.06 Quality Assurance

A. Conservation Treatment Quality Control Plan: Prior to commencing work of this section, receive written approval of plan of proposed masonry restoration and cleaning work. Include the following:

1. Description of sequencing, work procedures, materials, and tools proposed for each conservation treatment.
    a. Effects of weather variations on sequencing of treatments, construction schedule, and protection of completed work.
2. Survey of original wall layout and datum points and plumb lines for rebuilding masonry.
3. Description of removal of deteriorated mortar joint.
4. Description of matching of repair material and compatibility with historic materials.
5. Description of periodic and final cleaning of masonry surfaces.
6. Description of masonry removal and matching procedures including, but not limited to, equipment, approach, length of time the masonry will be out of the wall, mapping removal locations, and location where masonry units will be repaired, on-site or off-site.

B. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1. Maintain one copy of each document on project site.

C. Mortar Testing Agency Qualifications: Independent firm specializing in performing analysis of historic masonry mortar.

D. Restorer Qualifications: Company specializing in period masonry restoration with minimum five years of documented experience.

1. Use experienced masons who have demonstrated proficiency with tools on historic structures.

1.07 Mock-Ups

A. Restore and repoint existing masonry wall defined as follows and on drawings. Include mortar, accessories, wall openings, and flashings.

1. Repointing Mortar Joints:
    a. Minimum Dimensions: 12 feet (4 m) long; 2/3 of length for horizontal joints and 1/3 of length for vertical joints.

b. Demonstrate cutting out mortar joints, preparation for repointing, and mixing, installing, and curing mortar.
c. Prepare and place repointing mortar in accordance with guidance provided in NPS (THP) Preservation Brief 2.

B. Locate mock-up areas where directed.

C. Approved restoration mock-up areas, including results of procedures employed, will remain and become the quality standard for work of this section.

1.08 Delivery, Storage, and Handling

A. Deliver masonry materials neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

1.09 Field Conditions

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 Cleaning Materials

A. Cleaning Agent: Detergent type.

2.02 Mortar Materials

A. Hydrated Lime: ASTM C207, Type S.

B. Portland Cement: ASTM C150/C150M, Type I; color required to match approved color sample.

1. Not more than 0.60 percent alkali.

C. Water: Clean and free of oils, acids, alkalies, salts, organic materials, or other substances that are deleterious to mortar or metal it comes in contact with.

D. Sand: ASTM C144.

E. Mortar Mixing:

1. General Requirements:
a. Do not use modern additives unless permitted in writing by Architect.
b. NHL Mortar: Mix in accordance with manufacturer's instructions.
c. Match the historic mortar in color, texture, and tooling.

d. Provide mortar that has same vapor permeability and same or slightly lower compressive strength than the historic mortar.

2. Mortar for Brick:
   a. Use lime and sand mortars.

2.03 Masonry Unit Materials

A. Replacement Facing Brick: Match existing historic brick color, shape, size, texture, and general appearance.

1. Comply with ASTM C216, Type FBA, Grade SW.
2. Color and texture: Basis-of-Design: Subject to compliance with requirements, provide "920-926" by Belden Brick Co. or approved equal by one of the following:.
   a. Glen-Gery Brick.
   b. Meridian Brick.
   c. Watsontown Brick.
3. Actual size: 2-1/4" x 3-5/8" x 8".
4. Special shapes: Molded units as required, unless standard units can be sawn to produce equivalent effect.

PART 3 EXECUTION

3.01 Period Treatment, General

A. See Section 013591 for special procedure requirements related to elements and features of historical significance and value.

3.02 Examination

A. Verify that surfaces to be cleaned and restored are ready for work of this section.

3.03 Preparation

A. Protect other elements from damage that may result from restoration procedures.

B. Carefully remove and store identified items located in areas to be restored including, but not limited to, fixtures, fittings, finish hardware, and accessories; reinstall upon completion of restoration work.

C. Protect nonrestoration areas from restoration areas to prevent damage.

D. Mask or cover adjacent surfaces and permanent equipment. Secure coverings without using nails and without tape that leaves residue. Do not use impervious sheeting which produces condensation.

1. Use materials that will withstand cleaning and restoration procedures.

E. When using liquid cleaning methods, provide drainage devices to prevent runoff over adjacent surfaces, unless those surfaces are impervious to damage from runoff.

F. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.04 Installation

A. Do not mix or apply materials when the ambient temperature or humidity are outside of range recommended by their manufacturers.

B. Schedule conservation treatments to be carried out during appropriate environmental conditions to avoid weather-related failures.

3.05 Masonry Unit Replacement

A. Cut out damaged and deteriorated masonry to prevent damage to adjacent materials.

B. Cut away loose or unsound, adjoining masonry as directed.

C. Mortar Mix: Color and proportion to match existing.

D. Install built-in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build-in all openings, accessories, and fittings.

3.06 Repointing

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2-inch (6 mm) depth or until sound mortar is reached.

C. Exercise appropriate caution to prevent damage to existing masonry.

D. When cutting is complete, remove dust and loose material with air jet.

E. Premoisten joints and apply pointing mortar. Pack tightly in maximum 1/4-inch (6 mm) layers. Form a smooth, compact concave joint to match existing.

F. Moist cure for 72 hours.

3.07 Restoration Cleaning

A. Preclean surfaces and remove large particles with wood scrapers or nonferrous wire brush.

B. Preparatory Exterior Masonry Cleaning: Use safe spray pressures for each type of item to be cleaned.

1. Account for use of detergent and abrasives in cleaning solutions when setting pressure and flow of spray.
2. Use low-pressure spray at 100 to 400 psi (0.69 to 2.76 MPa) and 4 to 6 gpm (0.25 to 0.4 L/s) flow rate for cleaning brick.

C. Restoration Cleaners:

1. Apply restoration cleaner on masonry using brush or roller in accordance with manufacturer's instructions.
2. Provide a second application if required to match mock-up area.
3. Allow sufficient time, as recommended by manufacturer, for solution to remain on masonry.

D. Washing or Rinsing Vertical Surfaces:

1. Rinse from the bottom up with potable water applied at 600 psi (4140 kPa) and at a rate of 6 gpm (24 L/min) through a 15 to 45 degree fan spray tip.
   a. Use adjustable equipment capable of reducing water pressure and flow rate as needed for sensitive surfaces.
   b. Rinse with water and pressure sufficient to flush restoration cleaner and dissolved soiling from the masonry surface and surface pores without damaging masonry. Do not leave cleaning procedure residues on masonry.

3.08 Cleaning

A. Remove stains, efflorescence, or other excess resulting from the work of this section. Do without delay to avoid penetration and setting.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.

1.02 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.

5. Shop primer.
6. Galvanized-steel primer.
7. Etching cleaner.
8. Galvanized repair paint.
9. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members not to be shop primed.

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Material Sample Test Report: Obtain a sample from end corner of outstanding leg of existing truss web of the existing truss web end diagonal. Submit results to engineer before preparing structural steel shop drawings.

C. Welding certificates.

D. Welding Procedure for welding to existing trusses.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers..
5. Nonshrink grout.

F. Survey of existing conditions.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

a. Use Allowable Stress Design; data are given at service-load level.

C. Construction: Braced frames.

2.02 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles, M-Shapes: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

1. Weight Class: Standard.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating.
2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

2.04 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 55, weldable, straight.

1. Nuts: ASTM A563 heavy-hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

B. Threaded Rods: ASTM A36/A36M.

1. Nuts: ASTM A63 heavy-hex carbon steel.
2. Washers: ASTM A36/A36M carbon steel.
3. Finish: Plain.

2.05 FORGED-STEEL STRUCTURAL HARDWARE

A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.

B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.

C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

2.06 PRIMER

A. Steel Primer:

1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#134.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.07 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.08 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill,or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 3.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.09 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type:
   a. Snug tightened unless noted otherwise.
   b. Slip critical at braced frames and members with reversed loading unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.010 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.011 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 6 (WAB)/NACE WAB-3.

C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.012 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   a. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   b. Ultrasonic Inspection: ASTM E164.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in

permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
   1. Joint Type:
      a. Snug tightened unless noted otherwise.
      b. Slip critical at braced frames and members with reversed loading unless noted otherwise.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

   1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.05 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

   1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.06 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

    a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
        1) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
        2) Ultrasonic Inspection: ASTM E164.

END OF SECTION

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.02 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Composite floor deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.03 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

a. Power-actuated mechanical fasteners.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

B. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and Class 1-90 windstorm ratings. Identify materials with FM Approvals Certification markings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.02 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cordeck.
2. CSC, A Canam Steel Corporation Company
3. DACS, Inc.
4. New Millennium Building Systems, LLC.
5. Vulcraft

B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches.
4. Design Uncoated-Steel Thickness: 0.0418 inch.
5. Span Condition: Simple span.
6. Side Laps: Overlapped.

2.03 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cordeck.
2. CSC, A Canam Steel Corporation Company
3. DACS, Inc.
4. New Millennium Building Systems, LLC.
5. Vulcraft

B. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth:2 inches.
3. Design Uncoated-Steel Thickness: 0.0358 inch.
4. Span Condition: Triple span or more.

2.04 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Galvanizing Repair Paint: ASTM A780/A780M.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.03 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 6 inches apart.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 12 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.04 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing:

    a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches apart, but not more than 18 inches apart.
    b. Space and locate welds as indicated.

3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.05 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.

    a. Field welds will be subject to inspection.

2. Steel decking will be considered defective if it does not pass tests and inspections.
3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
    b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Formed steel joist framing and bridging.

1.02 RELATED REQUIREMENTS

A. Section 072100 - Thermal Insulation: Insulation within framing members.

B. Section 079200 - Joint Sealants.

C. Section 092116 - Gypsum Board Assemblies: Cold-formed steel nonstructural framing.

D. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

E. Section 095100 - Acoustical Ceilings: Ceiling suspension system.

1.03 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.04 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Describe method for securing studs to tracks and for bolted framing connections.

E. Design Data:

1. Shop drawings signed and sealed by a professional structural engineer.
2. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.

F. Inspection Reports: Provide material verification Inspection Reports in accordance with requirements of AISI S240.

G. Designer's Qualification Statement.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:

1. CEMCO; www.cemcosteel.com/#sle.
2. ClarkDietrich; www.clarkdietrich.com/#sle.
3. MarinoWARE; www.marinoware.com/#sle.
4. Telling Industries; www.tellingindustries.com/#sle.

B. Connectors:

1. Same manufacturer as metal framing.

2.02 Performance Requirements

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

B. Design Criteria: In accordance with applicable codes.

1. Live load deflection meeting the following, unless otherwise indicated:
   a. Floors: Maximum vertical deflection under live load of 1/480 of span.
   b. Roofs: Maximum vertical deflection under live load of 1/240 of span.
   c. Design nonaxial loadbearing framing to accommodate not less than 1/2 in (13 mm) vertical deflection.
2. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
3. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Structural Grade: As required to meet design criteria.

B. Jamb Studs: AISI S240; manufactured, engineered, c-shaped with wide flanges, designed to replace conventional double-stud framing at openings.

1. Structural Grade: As required to meet design criteria.

C. Headers: AISI S240; manufactured, engineered one-member or two-member assemblies, with wide flanges, designed to replace conventional box or nested header framing at openings.

1. Structural Grade: As required to meet design criteria.
2. Jamb Mounting Clips: Manufacturer's standard.

D. Joists: AISI S240; manufactured, engineered open-web steel joists.

1. Structural Grade: As required to meet design criteria.

2.05 CONNECTIONS

A. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1. Structural Grade: As required to meet design criteria.

C. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

D. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.

1. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
2. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).

E. Fixed Connections: Provide nonmovement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.06 Miscellaneous Connections

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M.

2.07 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 PREPARATION

A. Structural Wall Foundations: For gaps between wall bottom track and top of foundation 1/4 inch (6.4 mm) or greater, level substrate with loadbearing shims or grout between track and foundation.

3.03 Installation - General

A. Install structural members and connections in compliance with ASTM C1007.

3.04 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

D. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

H. Attach cross studs to studs for attachment of fixtures anchored to walls.

I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.05 INSTALLATION OF JOISTS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

D. Provide web stiffeners at reaction points.

3.06 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide inspections for welding, mechanical fastening, and cold-formed steel light-frame construction in accordance with requirements of AISI S240.

3.07 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft (3.2 mm in 3000 mm), in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch (3.2 mm) in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch (3.2 mm) from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION

SECTION 055100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Stairs with metal treads.

C. Structural steel stair framing and supports.

D. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 055213 - Pipe and Tube Railings: Metal handrails and balusters other than specified in this section.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

K. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

L. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

M. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

P. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

S. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 033100 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Design Data: As required by authorities having jurisdiction.

D. Design Data, Seismic Performance: Submit documentation that stairs meet performance requirements specified.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
3. Structural Design: Provide complete stair and railing assemblies that comply with the following:
    a. Stair Capacity: Uniform live load of 100 lb/sq ft (4.7 kPa) and a concentrated load of 300 lb (and a concentrated load of 14.4 kg) with deflection of stringer or landing framing not to exceed 1/360 of span.
    b. Railing Assemblies: Comply with applicable local code.
    c. Seismic Performance: Stairs designed to withstand the effects of earthquake motions determined according to ASCE 7.
        1) Component Importance Factor: 1.5.
        2) No permanent inelastic deformation occurs under movements equal 2.5 percent interstory drift, minimum.
4. Dimensions: As indicated on drawings.
5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
   a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
   b. Welds Exposed to View: Ground smooth and flush.
   c. Mechanical Joints: Butted tight, flush, and hairline.
   d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
   e. Exposed Edges and Corners: Eased to small uniform radius.
   f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
2. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
   a. Welded Joints: Welded on back side wherever possible.
   b. Welds Exposed to View: Ground smooth; not required to be flush.
   c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
   d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS (Stair A and Stair B)

A. Jointing and Finish Quality Level: Commercial, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.

1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
4. Concrete Reinforcement: Welded wire mesh.
5. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.

1. Riser/Nosing Profile: Vertical riser with underside of nosing sloped up from bottom of tread pan at not less than 60 degrees from horizontal, with rounded top of nosing of minimum radius.
2. Nosing Depth: Not more than 1-1/2 inch (38 mm) overhang.
3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch (12 mm) wide.

E. Stringers: Rolled steel channels.

1. Stringer Depth: 10 inches (250 mm).
2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Railings: Steel pipe railings.

G. Finish: Shop- or factory-prime painted.

2.03 METAL STAIRS WITH METAL TREADS (Stair C)

A. Jointing and Finish Quality Level: Service, as defined above.

B. Risers: Open.

C. Treads: Checkered steel plate.

1. Tread Thickness: 1/4 inch (6 mm), minimum.
2. Nosing: Plate bent to minimum radius with down return of 1 inch (25 mm).
3. Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.

D. Stringers: Rolled steel channels.

1. Stringer Depth: 10 inches (250 mm).
2. End Closure: Sheet steel of same thickness as risers welded across ends.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

F. Railings: Steel pipe railings.

G. Finish: Shop- or factory-prime painted.

2.04 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.

1. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.

B. Guards:

1. Top Rails: Round pipe or tube rails unless otherwise indicated.
   a. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.
2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
   a. Outside Diameter: 1 inch (25 mm).
   b. Material: Steel pipe or tube, round.
   c. Vertical Spacing:
      1) Maximum 4 inches on center for Stair A and Stair B.

2) Maximum 21 inches on center for Stair C.

d. Jointing: Welded and ground smooth and flush.

3. End and Intermediate Posts: Same material and size as top rails.
   a. Horizontal Spacing: As indicated on drawings.
   b. Mounting: Welded to top surface of stringer.

2.05 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.

1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.

G. Concrete Fill: Portland cement Type I, 3000 psi (20 MPa) 28 day strength, 2 to 3 inch (51 to 76 mm) slump.

H. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.06 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

D. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.07 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.

1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.05 SCHEDULES

A. Stairs A and B: Concrete-filled pan treads and landings, with primed finish.

B. Stair C: Checkered plate treads and landings, with primed finish.

END OF SECTION

SECTION 055133 - METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated ladders.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

H. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Sample warranty.

D. Executed warranty.

1.05 Warranty

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for material and workmanship. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Plates: ASTM A283/A283M.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

D. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

E. Bolts, Nuts, and Washers: ASTM A307, plain.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Finish: Powder coat; color to be selected by Architect from manufacturer's standard range.

3. Manufacturers:
   a. Alaco Ladder Company; 560 Series Fixed Wall Ladder: www.alacoladder.com.
   b. Industrial Ladder & Scaffolding, Inc; www.anyladder.com.
   c. O'Keeffe's Inc; Model 501: www.okeeffes.com.
   d. Precision Ladders, LLC; Fixed Aluminum Wall Ladder: www.precisionladders.com.

2.04 FINISHES - STEEL

A. Prime paint steel items.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stair railings and guardrails.

B. Guardrails

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 092116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

B. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

C. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

E. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

F. AWS C3.4M/C3.4 - Specification for Torch Brazing; 2016.

G. AWS C3.5M/C3.5 - Specification for Induction Brazing; 2016, with Amendment (2017).

H. AWS C3.9M/C3.9 - Specification for Resistance Brazing; 2020.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

D. Designer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
2. For anchorage to stud walls, provide backing plates, for bolting anchors.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

H. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.

1. Ease exposed edges to a small uniform radius.
2. Welded Joints:
    a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.

2.02 STEEL RAILING SYSTEM

A. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: No exposed bolts or screws.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel decorative railings with stainless steel wire-rope guard infill and wood top rail.

1.3 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.4 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
3. Refer to mockup.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Stainless Steel Decorative Railings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AGS Stainless Inc
b. Julius, Blum & Co., Inc.
c. Hollaender Manufacturing Company.

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01000 “General Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 STAINLESS STEEL

A. Wire Rope and Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AGS Stainless Inc
b. Julius, Blum & Co., Inc.
c. Hollaender Manufacturing Company.

2. Wire Rope: 7-by-19 wire rope made from wire complying with ASTM A492, Type 316.
3. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
4. Wire Thickness: 3/16”

2.5 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A500/A500M (cold formed).

C. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

D. Plates, Shapes, and Bars: ASTM A36/A36M.

2.6 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Type 304 stainless steel fasteners where exposed.
2. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
3. Dissimilar Metals: Type 304 stainless steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are the standard fastening method for railings indicated.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

2.7 MISCELLANEOUS MATERIALS

A. Wood Rails: Clear, straight-grained hardwood rails secured to recessed metal subrail.

1. Species: White Oak – Contractor to verify during mockup
2. Finish: Transparent polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Profile: As indicated on drawings.

B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

C. Intermediate Coats and Topcoats: Provide products that comply with Section 099123 "Interior Painting."

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.8 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form work true to line and level with accurate angles and surfaces.

D. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

E. Connections: Fabricate railings with welded connections unless otherwise indicated.

F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.

G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

H. Form changes in direction as follows:

1. As detailed.

I. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of hollow railing members with prefabricated end fittings.

K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.10 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, but galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

D. Shop-Painted Finish: Comply with Section 099123 "Interior Painting."

1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

C. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

D. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with sleeves concealed within railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.6 CLEANING

A. Clean wood rails by wiping with a damp cloth and then wiping dry.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 060312 - HISTORIC WOOD REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment of wood in the form of repairing wood features as follows:

1. Repairing wood trim.

B. Related Requirements:
1. Section 080352 "Historic Treatment of Wood Windows" for historic wood window repairs, including related trim.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic wood repair.
2. Review methods and procedures related to historic wood repair.

1.3 SUBMITTALS

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.4 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic wood-repair specialist, experienced in repairing, refinishing, and replacing wood in whole and in part. Experience only in fabricating and installing new woodwork is insufficient experience for wood historic treatment work.

B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing wood-patching compound that have been used for similar historic wood-treatment applications with successful results, and with factory-authorized service representatives who are available for consultation, Project-site inspection, and on-site assistance.

PART 2 - PRODUCTS

2.1 HISTORIC WOOD REPAIR, GENERAL

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWMAC/WI's "North American Architectural Woodwork Standards" for construction, finishes, grade rules, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Paragraph 6, "Industry Practices," under Article 12.1, "Basic Considerations," of AWMAC/WI's "North American Architectural Woodwork Standards" do not apply to the Work of this Section.

2.2 WOOD-REPLACEMENT MATERIALS

A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.

2.3 WOOD-REPAIR MATERIALS

A. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound must be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound must be capable of filling deep holes and spreading to featheredge.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Abatron, Inc.
b. ConServ Epoxy LLC.
c. Gougeon Brothers, Inc.
d. Polymeric Systems, Inc.
e. Protective Coating Company.
f. System Three Resins, Inc.

2.4 MISCELLANEOUS MATERIALS

A. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.

B. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.

C. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

2.5 WOOD FINISHES

A. Unfinished Replacement Units: Provide exposed exterior wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean wood of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

B. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 HISTORIC WOOD REPAIR, GENERAL

A. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Use mechanical means to remove coatings. Remove coatings that are loose or fail to adhere to wood substrate when scraped using hand tools. .
3. Repair items in place where possible.
4. Install temporary protective measures to protect wood-treatment work that is indicated to be completed later.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the Work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods, such as wire brushing or power tools, except as approved by Architect.

C. Repair Wood: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood by limited replacement matching existing material.

D. Replace Wood: Where indicated, duplicate and replace units with units made from salvaged, sound, original wood or with new wood matching existing wood. Use surviving prototypes to create patterns for duplicate replacements.

E. Identify removed items with numbering system corresponding to item locations, to ensure reinstallation in same location.

3.3 WOOD PATCH-TYPE REPAIR

A. General: Patch wood that exhibits depressions, holes, or similar voids, and that has limited amounts of rotted or decayed wood.

1. Remove rotted or decayed wood down to sound wood.

B. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
3. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.

3.4 WOOD-REPLACEMENT REPAIR

A. General: Replace parts of or entire wood items at locations indicated on Drawings and where damage is too extensive to patch.

1. Remove broken, rotted, and decayed wood down to sound wood.
2. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
3. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.

B. Repair remaining depressions, holes, or similar voids with patch-type repairs.

C. Reinstall items removed for repair into original locations.

END OF SECTION

SECTION 061000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Roofing nailers.

C. Roofing cant strips.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Miscellaneous framing and sheathing.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 072100 - Thermal Insulation: Venter rigid board insulation factory-adhered to wood nailers and plywood sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.

D. PS 1 - Structural Plywood; 2023.

E. PS 2 - Performance Standard for Wood Structural Panels; 2018.

F. PS 20 - American Softwood Lumber Standard; 2021.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Provide sustainably harvested wood; see Section 016000 - Product Requirements for requirements.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):

1. Species: Douglas Fir-Larch.
2. Grade: No. 2.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Roof Sheathing: Plywood Sheathing.

1. Bond Classification: Exterior.
2. Thickness: 1/4 inch
3. Size: 48 inches by 96 inches.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:

1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Treat rough carpentry items as indicated .
   c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 GENERAL

1.01 Section Includes
A. Sheathing.

1.02 Related Requirements
A. Section 072500 - Weather Barriers.

1.03 REFERENCE STANDARDS
A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

B. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

1.04 Submittals
A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Provide technical data on sheathing, wood preservative materials, and application instructions.

1.05 Delivery, Storage, and Handling
A. Store products above ground in dry ventilated space to protect against moisture. Support stacked products to prevent deformation and allow air circulation.

B. Protect materials from soiling and damage.

C. Deliver materials to site promptly without undue exposure to weather.

D. Do not stack panels over plus or minus 1/2 inch (13 mm) off pallet edge.

PART 2 PRODUCTS

2.01 Sheathing
A. Glass-mat-faced gypsum wall sheathing, comply with ASTM C1177/C1177M.

1. Thickness: 1/2 inch (12.7 mm).
2. Edges: Square.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.02 Accessories

A. Fasteners and Anchors:

1. General: Refer to manufacturer product information for fastener types and requirements.

PART 3 EXECUTION

3.01 Examination

A. Verify framing meet deflection criteria noted in drawings, as recommended by manufacturer and local building code requirements.

B. Examine substrates and adjoining construction.

C. Replace damaged framing before installation of cementitious panel subfloor. Proceed with installation only after unsatisfactory conditions corrected.

3.02 Installation

A. Select material sizes to minimize waste.

B. Reuse and clearly separate scrap for use on-site as accessory components, including shims, bracing, and blocking.

C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

1. Install control joints at every building construction joint and as recommended by cladding system manufacturer. Refer to sheathing manufacturer for more information.

END OF SECTION

SECTION 070150.19 - PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Partial replacement of existing roofing system in preparation for replacement roofing system in designated areas as indicated on drawings.

B. Removal of existing flashing and counterflashings.

C. Temporary roofing protection.

1.02 RELATED REQUIREMENTS

A. Section 061500 - Wood Decking.

B. Section 072100 - Thermal Insulation

C. Section 073126 - Slate Shingles

D. Section 076200 - Sheet Metal Flashing and Trim: Replacement of flashing and counterflashings.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1. Attendees:
   a. Architect.
   b. Contractor.
   c. Owner.
2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
   a. Removal and installation schedule.
   b. Necessary preparatory work.
   c. Protection before, during, and after roofing system installation.
   d. Removal of existing roofing system.
   e. Installation of new roofing system.
   f. Temporary roofing and daily terminations.
   g. Transitions and connection to and with other work.

C. Schedule work to coincide with commencement of installation of new roofing system.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Submit for each type of material.

C. Shop Drawings: Indicate size, configuration, and installation details.

D. Materials Removal Company Qualification Statement.

E. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.07 FIELD CONDITIONS

A. Existing Roofing System: Slate shingle roofing.

B. Maintain continuous temporary protection prior to and during installation of new roofing system.

C. Owner will not occupy building areas directly below re-roofing area.

PART 2 PRODUCTS

2.01 COMPONENTS

A. See the following sections for additional information on components relating to this work:

1. Partial removal of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings, see Section 075100.

2.02 MATERIALS

A. Temporary Roofing Protection Materials:

1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.03 ACCESSORIES

A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Remove metal counter flashings.

B. Remove existing slate material, using care to avoid damage to the maximum extent possible. Existing slate is to be salvaged and turned over to Owner.

3.04 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 073126 for additional requirements.

3.05 PROTECTION

A. Provide temporary protective sheeting over uncovered deck surfaces.

END OF SECTION

SECTION 071400 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

1.01.A. Modified-polymer elastomeric waterproofing.

1.02 REFERENCE STANDARDS

1.02.A. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

1.02.B. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.03 SUBMITTALS

1.03.A. See Section 013000 - Administrative Requirements for submittal procedures.

1.03.B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

1.03.C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03.D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

1.03.E. Manufacturer's qualification statement.

1.03.F. Installer's qualification statement.

1.04 QUALITY ASSURANCE

1.04.A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.04.B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 FIELD CONDITIONS

1.05.A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.01.A. Modified-Polymer Elastomeric Waterproofing:
1. Carlisle Coatings & Waterproofing, Inc; MiraSEAL: www.carlisleccw.com/#sle.
2. Henry Company; Henry CM100: www.henry.com/#sle.
3. W. R. Meadows, Inc; HYDRALASTIC 836: www.wrmeadows.com/#sle.

2.02 FLUID-APPLIED WATERPROOFING APPLICATIONS

2.02.A. Modified-Polymer Elastomeric Waterproofing:
1. Location: At portions of Wing Hall where waterproofing has been removed to facilitate new Work..

2.03 ACCESSORIES

2.03.A. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

2.03.B. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
1. Recycled or reclaimed closed-cell foam plastic with non-woven filter fabric cover; 1 inch (25 mm) thick.

2.03.C. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
1. Composition: Dimpled polyethylene, polypropylene, or polystyrene core; polypropylene or polyester filter fabric.
2. Thickness: As indicated on drawings.
3. Core Compressive Strength: 15,000 psf (0.72 MPa), minimum, in accordance with ASTM D1621

PART 3 EXECUTION

3.01 EXAMINATION

3.01.A. Verify existing conditions before starting work.

3.01.B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

3.01.C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

3.01.D. Verify that items penetrating surfaces to receive waterproofing are securely installed.

3.01.E. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

3.01.F. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

3.02.A. Protect adjacent surfaces from damage not designated to receive waterproofing.

3.02.B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

3.02.C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

3.02.D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

3.02.E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION

3.03.A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.

3.03.B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.03.C. Apply extra thickness of waterproofing material at corners, intersections, and angles.

3.03.D. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

3.03.E. Extend waterproofing material and flexible flashing into drain clamp flange, apply adequate coating of liquid membrane to ensure clamp ring seal, and coordinate with drain installation requirements; see Section 221006.

3.03.F. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL and PROTECTION BOARD

3.04.A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward, and scribe and cut boards around projections, penetrations, and interruptions.

3.04.B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

3.05 PROTECTION

3.05.A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at underside of floor slabs, over roof sheathing, and exterior wall behind metal-stud with gypsum wall board wall finish.

B. Batt insulation in interior wall and ceiling construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. 070150.19 - Preparation for Re-Roofing.

B. 076100 - Slate Shingles: Installation of slate roofing shingles over composite board insulation.

1.03 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.

1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.

G. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation on Inside of Concrete and Masonry Exterior Walls: Mineral fiber board.

C. Insulation on Inside of Masonry Exterior Wals with Metal Framed Furring: Mineral fiber batt insulation with separate vapor retarder.

D. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

E. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

F. Insulation over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.

1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
4. Board Edges: Square.
5. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
6. Products:
   a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge : building.dupont.com/#sle.
   b. Kingspan Insulation LLC; GreenGuard GG25-LG XPS Insulation Board: www.kingspan.com/#sle.
   c. Owens Corning Corporation; FOAMULAR Type 250 Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.

1. Classifications:
   a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of core foam.
      2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
      3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).
5. Board Thickness: 1.5 inch (37.5 mm) minimum, or greater to achieve required total system R-value when installed with compnents specified elsewhere in this section.
6. Board Edges: Square.
7. Products:
   a. Atlas Roofing Corporation; ACFoam-II GRF Roof Insulation: www.atlasroofing.com/#sle.
   b. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
   c. Hunter Panels; Xci Foil (Class A): www.hunterpanels.com/#sle.

C. Rigid Cellular Polyisocyanurate (ISO) Thermal Insulation Board Composite Ventilated with Wood Spacers and Faced with Oriented Strand Board (OSB) or Plywood: Provide with 1 inch (25 mm) thick wood spacers between foam and OSB or plywood; complying with ASTM C1289.

1. Classifications:
   a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.

1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).

2. Top Layer Material: 7/16 inch (11 mm) oriented strand board (OSB).
3. Board Size: 48 by 96 inch (1220 by 2440 mm).
4. Composite Insulation Board Thickness: 5.0 inch (127 mm).
5. Board Edges: Square.
6. Products:
   a. Atlas Roofing Corporation; ACFoam CrossVent Cross Ventilated Roof Insulation: www.atlasroofing.com/#sle.
   b. GAF; ThermaCal Nail Base Roof Insulation Panels: www.gaf.com/#sle.
   c. Hunter Panels; Cool-Vent: www.hunterpanels.com/#sle.

2.03 MINERAL FIBER BOARD INSULATION MATERIALS

A. Mineral Wool Block, Board, or Blanket Thermal Insulation: Complying with ASTM C612 or ASTM C553.

1. Where indicated, provide fiberglass reinforced polypropylene facing on one side; with flame spread index of 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Board Size: 16 by 48 inches (405 by 1220 mm).
4. Board Thickness: 2 inches (51 mm).
5. Thermal Resistance: R-value (RSI-value) of 4.2 (0.74) per inch at 75 degrees F (24 C), minimum, when tested in accordance with ASTM C518.
6. Maximum Density: 8 pcf (128 kg/cu m), nominal.
7. Products:
   a. Johns Manville; CladStone Water & Fire Block Insulation: www.jm.com/#sle.
   b. ROCKWOOL; ROCKBOARD 60: www.rockwool.com/#sle.
   c. Thermafiber, Inc; VERSABOARD 60: www.thermafiber.com/#sle.

2.04 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
2. Formaldehyde Content: Zero.
3. Thickness:
   a. Matching depth of stud cavity of interior walls.
   b. Minimum 6 inches when installed above lay-in acoustical ceilings
4. Products:
   a. CertainTeed Corporation; www.certainteed.com/#sle.

b. Johns Manville; www.jm.com/#sle.
c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.

1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Thickness: 5-1/4 inch (133 mm).
3. Products:
   a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
   b. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
   c. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.

2.05 ACCESSORIES

A. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mil, 0.012 inch (0.30 mm) thick.

1. Width: 4.9 feet (1.5 m).

B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.
2. Width: Are required for application.

C. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.

D. Gas-Actuated Insulation Fasteners: Galvanized steel pins driven through polypropylene anchor with 2-1/4-inch (57 mm) diameter washer head; suitable for fastening insulation to concrete, CMU, or steel studs, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Apply adhesive to back of boards:

1. Three continuous beads per board length.

B. Install boards horizontally on walls.

1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Tape insulation board joints.

3.03 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.04 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Install according to manufacturer's instructions.

B. Install without gaps or voids. Trim composite insulation panels neatly to fit spaces.

C. Ensure overall installation present flush, level surface.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

F. Tape seal tears or cuts in vapor retarder.

G. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

A. See Section 013000 - Submittal Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

E. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:

1. BASF Corporation; WALLTITE US Series Closed Cell: www.spf.basf.com/#sle.
2. Carlisle Spray Foam Insulation; SealTite Pro HFO: www.carlislesfi.com/#sle.
3. Johns Manville; JM Corbond IV Closed Cell Spray Polyurethane Foam : www.jm.com/#sle.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Thermal Resistance: R-value (RSI-value) of 7.1 (1.25), minimum, per 1-inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
2. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
4. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
5. Closed Cell Content: At least 90 percent.
6. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Do not apply cellulose fiber insulation in areas where temperatures exceed 150 degrees F (65.6 degrees C).

C. Patch damaged areas.

D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

E. Trim excess away for applied trim or remove as required for continuous sealant bead.

END OF SECTION

SECTION 072500 - WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive barriers.

1.02 RELATED REQUIREMENTS

A. Section 072100 - Thermal Insulation: Weather barrier installed in conjunction with batt insulation.

B. Section 074243 - Composite Wall Panels: Weather barrier installed in conjunction with exterior phenolic wall panel systems.

C. Section 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 DEFINITIONS

A. Weather Barriers: Materials or assemblies forming water-resistive barriers, air barriers, vapor retarders, or combination of one or more assemblies.

B. Water-Resistive Barriers: Materials or assemblies installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure; 2018, with Editorial Revision (2019).

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 Water-Resistive Barriers

A. Water-Resistive Barrier Building Wrap: Mechanically fastened building wrap.

1. Hydrostatic Pressure Resistance: Greater than 200 inches (500 cm) when tested in accordance with AATCC Test Method 127.
2. Water Vapor Permeance: maximum value of 23 perms when tested in accordance with ASTM E96/E96M, Procedure A.

2.02 Accessories

A. Seal and Perimeter Tapes: As recommended by water-resistive barrier manufacturer.

B. Flashings and Sealants: As recommended by water-resistive barrier manufacturer for application.

2.03 Fasteners

A. Self-Sealing Washers: Solid plastic, 2 inch (25 mm) diameter washers; seals building-wrap air barriers against air penetration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Mechanically Fastened Sheets:

1. Install sheets in shingle fashion to shed water; align horizontally.
2. Overlap seams as recommended by manufacturer, 6 inches (152 mm), minimum.
3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches (305 mm), minimum.
4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches (305 to 460 mm) on center along each framing member supporting sheathing.
5. Install water-resistive barrier over jamb flashings.
6. Install head flashings under water-resistive barrier.
7. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 072600 - VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor retarders.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 072100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

1.03 DEFINITIONS

A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.

B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:

1. Class I: 0.1 perm or less.
2. Class II: Greater than 0.1 perm to 1.0 perm.
3. Class III: Greater than 1.0 perm to 10 perms.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

C. ICC (IBC)-2018 - International Building Code; 2018.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 VAPOR RETARDERS

A. Underslab Vapor Retarders: See Section 033000.

B. Vapor Retarder Sheet: Polyamide nylon sheet intended for use with unfaced, vapor-permeable insulation such as fiberglass and mineral wool in wall and ceiling cavities.

1. Thickness: 2 mil, 0.002 inch (0.0508 mm).
2. Water Vapor Permeance: 1.0 perm (57 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method.
3. Surface Burning Characteristics: Smoke developed index of 450 or less, and flame spread index of 25 or less, Class A, when tested in accordance with ASTM E84.
4. Seam Lap and Perimeter Adhesive: Provide manufacturer's recommended method using either tape or sealants.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

B. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.

1. Width: 3-1/2 inches (89 mm).
2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.

C. Vapor Retarder Tape: Coated polyester film with acrylic adhesive backing; pressure sensitive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Mechanically Fastened Sheets - Vapor Retarder On Interior:

1. When insulation is installed within assembly, install vapor retarder over insulation.
2. Anchor to metal framing using seam tape, adhering at least one-half of tape width to metal substrate.
3. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.
4. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.
5. Seal entire perimeter to structure, window and door frames, and other penetrations.
6. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 073126 - SLATE SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Slate roofing shingles.

B. Water-resistant underlayment.

C. Metal roof flashing.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood attachment members.

B. Section 061000 - Rough Carpentry: Roof sheathing.

C. Section 076200 - Sheet Metal Flashing and Trim.

D. Section 070150.19 - Preparation for Re-Roofing.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

B. ASTM C406/C406M - Standard Specification for Roofing Slate; 2015.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).

F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

G. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2021).

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

I. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.

J. FM Property Loss Prevention Data Sheet 1-49; 2024.

K. FM Property Loss Prevention Data Sheet 1-54; 2024.

L. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2023.

M. NRCA (RM) - The NRCA Roofing Manual; 2024.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. FM Global Informational Submittal: FM Global Form 2688 Checklist for Roofing System to include exact trade names for all materials, adhesive application rates, fastener sizes and patterns for Zone 1-3 and material cut sheets.

C. Product Data: Manufacturer's data sheets on slate roofing, including material characteristics, application limitations, and recommendations for installation.

D. Shop Drawings: Details for specially configured metal flashing, joint configurations, and flashing locations.

E. Verification Samples: Actual shingles in each selected color and finish, illustrating full range of color and texture variation to be anticipated in the finished work.

F. Installer's qualification statement.

G. Sample warranty.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.
2. Extra Shingles: Quantity equal to 3 percent of total installed, but not less than one full carton.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain slate required for this project from one quarry with adequate resources to ensure consistent quality and appearance for project.

B. Installer Qualifications: Company specializing in installing slate roofing, with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shingles to project site in fabricator’s unopened crates or cartons, clearly labeled and identified.

B. Handle shingles to avoid chipping, breakage, soiling, or other damage. Protect edges with wood or other cushioning and protective material.

C. Stack skids and slate cartons to distribute weight evenly and to avoid breakage or cracking.

D. Immediately prior to installation, distribute stacked slate shingles on roof to facilitate installation and to avoid overloading roofing substrate.

1.07 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F (7 degrees C).

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Contractor's Warranty: Provide 5-year contractor water-tight guarantee on all roofing and related work, including sheet metal flashing and trim associated with roof installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Slate Shingles:

1. Greenstone Slate Company: Vermont Gray/Black; www.greenstoneslate.com.
2. North Country Slate; North Country Unfading Black: www.ncslate.com.
3. Vermont Slate Company, Inc.; Vermont Black: www.vermontslateco.com
4. Vermont Structural Slate Company, Inc; Grayson: www.vermontstructuralslate.com.

2.02 ROOFING MATERIALS

A. Slate Shingles: Hard, dense, sound rock, free of ribbons.

1. Classification: Grade S1, expected service life over 75 years, complying with ASTM C406/C406M.
2. Texture: Rough.
3. Thickness: 3/16 inch (5 mm), nominal.
4. Length: 12 inches (305 mm), nominal.
5. Width: 8 inches (203 mm), nominal.
6. Butt Shape: Standard square cut.
7. Color: As indicated.

B. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil, 0.040 inch (1.02 mm) total thickness; with strippable release film and woven polypropylene sheet top surface.

1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
4. Water Vapor Permeance: 0.067 perm (0.38 ng/(Pa s sq m)), when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).

5. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
6. Liquid Water Transmission: Passes ASTM D4869/D4869M.
7. Functional Temperature Range: From minus 70 degrees F (minus 56.7 degrees C) to 212 degrees F (100 degrees C).
8. Products:
   a. Certainteed Roofing; WinterGuard Pro Underlayment: www.certainteed.com/#sle.
   b. System Components Corporation, Inc; FelTex SA300: www.systemcomponents.net/#sle.
   c. Carlisle WIP Products; WIP 300HT: www.carlislewipproducts.com.

C. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; nominal total thickness of 40 mil, 0.040 inch (1.0 mm); with strippable release paper and polyethylene sheet top surface.

2.03 ACCESSORIES

A. Flashing:

1. Stainless Steel: Terne coated stainless steel; 0.015 inch (0.38 mm) thick; comply with ASTM A666, Type 304; coated both sides with terne alloy at 0.092 lb/sq ft (450 g/sq m).

B. Attachment Members:

1. Material: Pressure preservative treated wood complying with AWPA U1 Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
2. Nailers: Nominal 2 inches (50 mm) wide by 1-inch (25 mm) thick members, or thickness as required for specific conditions.
3. Cant Strips: Beveled strips, nominal size as indicated, nominal 48 inches (1220 mm) long and spaced nominal 1/2 inch (12.5 mm) apart at ends for drainage.

C. Nails: Slater's large-headed copper ring shank nails, length not less than twice slate thickness plus 1 inch (25 mm), or long enough to penetrate completely through roof sheathing.

D. Butyl Sealant: ASTM C1311 one-part non-sag polymerized butyl sealant.

E. Sealant: ASTM C920 low-modulus silicone joint sealer.

F. Metal Ridge and Hip Accessories: As indicated on drawings, same material as exposed flashings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roofing accessories and roofing penetrations are complete and properly flashed.

B. Verify that roof openings are correctly framed.

C. Verify that roof deck surfaces are dry and free of ridges, warping, and voids.

3.02 PREPARATION

A. Prepare deck surfaces using methods recommended by slate shingle manufacturer for existing project conditions.

B. Broom clean roof deck thoroughly prior to beginning installation.

3.03 INSTALLATION

A. Install slate shingle roofing system in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Sheet Metal Flashing: Install flashing as indicated and as required by project conditions.

1. Install flashing at each location where slate roof intersects other roofs, walls, parapets, chimneys, ventilators, and similar projections.
2. Fabricate flashings at open valleys with standing rib at center of valley, not less than 1 inch (25 mm) high; extend flashing not less than 12 inches (305 mm) onto roof deck on each side of valley.
3. Attach shingles at valleys using copper wires to copper straps nailed beyond edge of flashing sheets.
4. Install drip edge flashing at eaves prior to installing underlayment.
5. Install metal ridge cap in accordance with NRCA details and recommendations.

C. Underlayment:

1. Install underlayment over entire deck surface. Apply additional layer of underlayment not less than 36 inches (914 mm) wide at valleys.
2. Ice Dam Protection: Install eave protection membrane at eaves, extending to a line that when projected to the horizontal is not less than 24 inches (610 mm) inside of interior wall line.

D. Wood Attachment Members:

1. Cants: Install cant strips at eaves below eave flashing and underlayment.
2. Nailers: Install nailers at ridge and hips, directly over underlayment. Protect with additional layer of underlayment before installing ridge and hip slates and accessories.
3. Refer to FM Property Loss Prevention Data Sheet 1-49, Section 2.2.2 for additional requirements for wood nailers.

E. Slate Shingles:

1. Double shingles at eaves and cornice line. Beginning at eaves, project shingles minimum uniform dimension of 2 inches (51 mm) and lay shingles in horizontal courses. Install shingles with minimum of 3-inch (76 mm) headlaps, and stagger joints between courses a minimum of 3 inches (76 mm). Project shingles minimum uniform dimension of 1 inch (25.4 mm) at gables.

2. Cut and fit shingles neatly around vents, pipes, and other projections.

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

3.05 PROTECTION

A. Minimize traffic over finished roof surface, and when necessary wear soft-soled shoes and walk on butt or tab of slate shingles to avoid breakage.

B. Remove and replace damaged or broken slate shingles before Date of Substantial Completion.

END OF SECTION

SECTION 074213 - METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Wall panel substrate.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.04 SUBMITTALS

A. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:

1. Physical characteristics of components shown on shop drawings.
2. Storage and handling requirements and recommendations.
3. Installation instructions and recommendations.

B. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

C. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 15-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Wall Panels - Exposed Fasteners:

1. ATAS International, Inc; Corrugated Panel: www.atas.com/#sle.
2. Elevate; UNA-CLAD VR-Classic Omega: www.holcimelevate.com/#sle.
3. Fabral; Hefti-Rib: www.fabral.com/#sle.

2.02 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.

1. Provide exterior wall panels, interior liner panels, soffit panels, retrofit wall panels, and subgirt framing assembly.
2. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
3. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
4. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
5. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
6. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.

B. Exterior Wall Panels:

1. Profile: Horizontal.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Panel Width: 72 inches (1829 mm).
4. Color: As selected by Architect from manufacturer's standard line.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

D. Expansion Joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile to suit system.

E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Galvanized steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

2.05 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.

1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Fasten panels to structural supports; aligned, level, and plumb.

C. Locate joints over supports.

D. Lap panel ends 2 inches (51 mm), minimum.

3.03 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.

3.04 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

3.05 PROTECTION

A. Protect metal wall panels until completion of project.

B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 074243 - COMPOSITE WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. High pressure laminate composite wall panel system assemblies.
2. Attachment components and accessories.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for metal stud substrate support framing.
2. Section 061000 "Rough Carpentry" for wood stud substrate support framing.
3. Section 061600 "Sheathing" for wall sheathing substrates.
4. Section 072100 "Thermal Insulation" for continuous insulation behind exterior cladding.
5. Section 072500 "Weather Barriers" for water-resistive barriers.

1.02 DEFINITIONS

A. Composite Wall Panel System Assembly: Composite wall panels, attachment system components, integral flashings, miscellaneous metal framing, and accessories necessary for a complete façade cladding system.

B. Drained and Back-Ventilated Rainscreen System: Cladding system designed to drain and dry cavity entering water through drainage channels, weeps, and air ventilation.

1.03 COORDINATION

A. Coordinate composite wall panel system installation with rain drainage work, flashings, trim, and construction of studs, soffits, and other adjoining work to ensure proper sequencing and to provide a secure and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of composite wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of composite wall panel systems; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):

a. Flashing and trim.
b. Anchorage systems.
c. Stud framing.
d. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
e. Penetrations of wall by pipes and utilities.

C. Samples for Initial Selection: For each type of composite wall panel indicated with integral color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of composite wall panel indicated, prepared on Samples of size minimum 3-1/2 inches (89 mm) square.

1. Include similar Samples of trim and accessories involving color selection.

1.06 INFORMATIONAL SUBMITTALS

A. Delegated Design Submittal: For composite wall panel system assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and delegated design engineer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

D. Environmental Data:
1. Declare: LBC Red List Approved
2. Environmental Product Declaration (EPD) with statement on 50 years of reference service life.
3. FSC or PEFC Certification.
4. Health Product Declaration (HPD).
5. UL Greenguard Certification.
6. UL Greenguard Gold Certification.
7. USDA Biobased Certification.

E. Sample Warranty.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For composite wall panels, including related accessories, to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: ISO 9001 and ISO 14001 Certified.

2. Installer: All products listed in this Section are to be installed by an installing firm that can prove three years in business and exemplary workmanship. Installing firm must have evidence of installing rainscreen wall panel systems and is suitable for the execution of the work.
3. Delegated Design Engineer: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

B. Fire-Resistance Ratings: Where indicated, provide composite wall panels identical to those of assemblies tested for fire resistance in accordance with ASTM E119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Comply with manufacturer's written instructions for storage and handling to prevent breakage, bending, warping, twisting, and surface, edge, or corner damage.

C. Protect components from weather damage.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of composite wall panels to be performed in accordance with manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Warranty: Provide manufacturer's limited 10-year warranty covering defects in materials from date of shipment to fabricator.

1. Warranty coverage is based upon manufacturer's material property data sheet to include, but is not limited to, the following:

    a. ASTM D5420 Impact Resistance.
    b. EN 438-2:29 Florida cycle Exposure - 3000 hours with a grey scale of 4-5.

        1) Grey Scale Rating 5: No visible change.
        2) Grey Scale Rating 4: Change of gloss only.

    c. Deterioration of materials beyond normal weathering.

2. Warranty Period: [10] <Insert number> years from date of Delivery.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Provide components and materials specified in this Section from single manufacturer for a complete and compatible assembly.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Composite wall panel system assemblies will comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design composite wall panel system assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Performance: Provide composite wall panel system assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing in accordance with ASTM E330/E330M:

1. Design Wind Loads: Determine loads based on the following minimum design wind pressures:

    a. Uniform pressure of 20 lbf/sq. ft. (957 Pa), acting inward or outward.

2. Deflection Limits: Composite wall panel system assemblies will withstand wind loads with horizontal deflections no greater than 1/175 of the span or 3/4 inch (19 mm), whichever is less.

D. Fire-Resistance Performance: Comply with ASTM E119 for testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency acceptable to AHJ.
1. Surface-Burning Characteristics: Provide Class A composite wall panels with a flame-spread index of 50 or less and a smoke-developed index of 450 or less when tested in

accordance with ASTM E84. If the project is located in Canada provide a panel with a flame-spread index of 25 or less and a smoke-developed index of 50 when tested in accordance with CAN/ULC S102.2.

2. Self-Ignition Temperature: Not less than 650 deg F (350 deg C) when tested in accordance with ASTM D1929.
3. Burning Classification: CC1 or CC2 when tested in accordance with ASTM D635.

E. Fire Propagation Characteristics: Composite wall panel assembly passes NFPA 285-2019 or CAN/ULC S134 (Canada Only).

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

G. Exposure Performance:

1. Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100 percent relative humidity and 100 deg F (38 deg C) for 3000 hours when tested in accordance with ASTM D2247.
2. Resistance to Climactic Shock: No visible change when tested in accordance with EN 438-2:19.
3. Resistance to Artificial Weathering: No visible change when tested in accordance with EN 438-2:29 at a minimum of 3000 hrs.
4. Resistance to Artificial Weathering: No visible change when tested in accordance with Florida Test cycle (modified EN 438-2:29) at a minimum 3000 hrs.
5. Color Stability: The decorative surfaces comply with Classification 4 or 5 as measured with the ISO 105 A02 Grey Scale when tested in accordance with EN 438-2:29.
6. Resistance to Sulfur Dioxide (SO2): No visible change when tested in accordance with DIN 50018.
7. Thermal Resistance / Conductivity: Result of 0.3 W/mK when tested in accordance with EN 12524.

H. Physical Properties:

1. Resistance to Impact by Large-Diameter Ball: - 6 ≤ t mm at a drop height of 5.9 ft. (1.8 m) with a result of ≤ 0.38 inch (10 mm).
2. Impact Resistance: A result of 1.0466 ft. in height at 11.3 J in energy when tested in accordance with ASTM D5420.
3. Dimensional Stability at Elevated Temperatures: Cumulative dimensional change of ≤ 0.25 percent in the longitudinal and transversal direction when tested in accordance with EN 438-2:17.
4. Resistance to Wet Conditions:

    a. Mass increase of ≤ 3 percent and an appearance rating of ≥ 4 when tested in accordance with EN 438-2:15.
    b. No visible change when tested in accordance with ASTM D2247.

c. Water absorption result of 0.5 percent when tested in accordance with ASTM D2842.

5. Modulus of Elasticity:

a. Result of ≥ 9000 Mpa when tested in accordance with EN ISO 178.
b. Result of ≥ 1305000 psi when tested in accordance with EN ASTM D638.

6. Flexural Strength:

a. Result of ≥ 120 Mpa when tested in accordance with EN ISO 178.
b. Result of ≥ 17500 psi when tested in accordance with ASTM D790.

7. Tensile Strength:

a. Result of ≥ 70 Mpa when tested in accordance with EN ISO 527.
b. Result of ≥ 10150 psi when tested in accordance with ASTM D638.

8. Density:

a. Result of ≥ 1.35 g/cm3 when tested in accordance with EN ISO 1183.
b. Result of ≥ 1.35 g/cm3 when tested in accordance with ASTM D792.

9. Resistance to Fixings: Pull out strength of ≥ 3000 N for 0.3150 inch (8 mm) panel) and ≥ 4000 N for ≥ 0.3937 inch (10 mm) panel.

2.03 COMPOSITE WALL PANELS

A. Description: Exterior solid phenolic, high-pressure laminate with integrated electronic-beam cured cladding panels fabricated from mixture of proprietary materials as standard with manufacturer, as required to meet structural performance required in drained and back-ventilated rainscreen façade cladding system. Include attachment system components and accessories required for complete assembly.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Trespa North America, Ltd.; Meteon Exterior Façade Panels or a comparable product by one of the following:

a. Abet Laminati; Stone wood Architectural Panels; www.stonewoodpanels.com.
b. Fundermax, Inc; Max Compact Exterior Panels: www.fundermax.us

2. Surface Texture: Smooth, flat finish.
3. Panel Thickness: 3/8 inch (10 mm).
4. Nominal Panel Size: 8 by 6 ft.
5. Color: NA-18 “Natural Slate.”

B. Panel Mounting System: Manufacturer's proprietary panel fastening system suitable for drained and back-ventilated rainscreen system.

1. Basis-of-Design Construction System: Subject to compliance with requirements, provide Trespa North America; TS110-285 mounting system or a comparable product by one of the following:

    a. Abet Laminati; www.stonewoodpanels.com.

    b. Fundermax, Inc; www.fundermax.us

2.04 MISCELLANEOUS MATERIALS

A. Miscellaneous Subframing, General: ASTM B317, 6063-T5 or -T6 aluminum. Provide manufacturer's standard sections as required for support and alignment of composite wall panel system assembly.

1. Include manufacturer's standard [perimeter extrusions with integral weather stripping] [panel stiffeners] [panel clips] [and] [anchor channels].
2. Fasteners for Miscellaneous Metal Framing and Subframing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

B. Finishing Accessories and Trim: Provide [manufacturer's standard] [fabricated] trim, angles, and similar components at corners, transitions, and rough openings meeting the performance requirements. Finish to match composite wall panels.

C. Fasteners: Type 304 stainless steel self-tapping screws, minimum #12 x 1-inch in length, complying with ASTM C1002 as recommended in writing by composite wall panel system manufacturer suitable for and compatible with system materials.

D. Flashing and Trim: Provide aluminum flashing and trim as required to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, composite wall panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by composite wall panel system manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by composite wall panel system manufacturer.

3. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
4. Verify that air cavity space is continuous with unobstructed dimension at a minimum 3/4 inch (19 mm) and maximum dependent on appropriate Trespa wall composite system for full height of composite wall panel system.

B. Examine roughing-in for components and systems penetrating composite wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate surfaces thoroughly prior to installation. Prepare substrate surfaces using methods recommended in writing by composite wall panel system manufacturer.

B. Prepare subframing and provide anchorage for substrate type and exterior cladding type in accordance with composite wall panel system manufacturer's written instructions.

C. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage in accordance with ASTM C754 and composite wall panel system manufacturer's written instructions.

3.03 COMPOSITE WALL PANEL INSTALLATION

A. General: Install composite wall panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving composite wall panels.
2. Flash composite wall panels at perimeter of all openings. Do not begin installation until air- or water-resistive barrier and flashings that will be concealed by panels are installed.
3. Install flashing and trim as composite wall panel work proceeds.
4. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, for waterproofing.
5. Align bottoms of composite wall panels.

B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action in accordance with composite wall panel system manufacturer's written instructions.

C. Attachment System Installation, General: Install attachment system required to support composite wall panel system.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete composite wall panel assembly including trim, copings, corners, seam covers, flashings, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align composite wall panel system within installed tolerance of 1/4 inch in 20 ft. (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of composite wall panel installation, clean finished surfaces as instructed by panel manufacturer. Maintain in a clean condition during construction.

B. After composite wall panel installation, clear weep holes and drainage channels of obstructions.

C. Replace composite wall panels that have been damaged.

END OF SECTION

SECTION 075600.13 - FLUID-APPLIED MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes fluid-applied roof membrane system on metal deck, consisting of the following:

1. Vapor retarder.

2. Roof insulation and cover board.

3. Base-ply sheet in polyurethane adhesive.

4. Application of reinforced fluid-applied polyurethane roof membrane with full -coverage slip-resistant top coat, and membrane flashings.

B. Related Information:

1. Section 0610003 “Rough Carpentry" for wood blocking and nailers.

2. Section 070150.19 "Preparation for Re-Roofing" for existing roofing tear off and substrate preparation for installation of new roofing membrane.

3. Section 076200 "Roof Accessories" for manufactured reglets, copings and roof edge flashings.

1.02 PREINTALLATION MEETINGS

A. Prior to the beginning of the roofing work, a pre-roofing conference is to be held, attended by the Consultant, the Contractor, the Roofing Installer, a technical representative of the Roofing Manufacturer, the Mechanical Installer, the Campus, and the Fund Coordinator. The purpose of this conference is to review the specifications, drawings, details, application requirements, staging areas, crane set-up locations, storage areas, protection and safety precautions, and what work is to be completed before the roofing operation begins.

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and terminations.

2. Tapered insulation, including slopes.

3. Crickets, saddles, and tapered edge strips, including slopes.

C. Samples for Verification: For the following products:

1. 1-by-3-inch sample of reinforced fluid-applied membrane.

2. 3-by-5-inch sample of SBS-modified roofing base ply.

3. 3-by-5-inch sample of SBS-modified vapor retarder ply.

4. 4-by-4-inch sample of roof insulation and cover board.

1.05 INFORMATIONAL SUBMITTALS

A. Contractor's Product Certificate: Submit certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.

B. Manufacturer’s Certificate: Submit letter, written for this project, including code-compliant wind uplift assembly approval and UL TGFU fire rating, as specified.

C. Qualification Data: For Installer.

1. Letter written for this Project indicating manufacturer approval of Installer to apply specified products and provide specified warranty.

D. Warranties: Unexecuted sample copies of special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

B. Warranties: Executed copies of approved warranty forms.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor, Architect, and employees, and the following:

1. Qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section, with minimum five years' experience in manufacture of specified products in successful use in similar applications.

1. Approval of Other Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

    a. Product data, including certified independent test data indicating compliance with requirements.

    b. Samples of each component.

    c. Sample submittal from similar project.

    d. Project references: Minimum of five installations of specified products not less than five years old, with Owner and Architect contact information.

    e. Sample warranty.

C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

2. An independent party certified as a Registered Roof Observer by the International Institute of Building Enclosure Consultants (formerly the Roof Consultants Institute) retained by the Contractor or the Manufacturer and approved by the Manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Handle and store roofing materials, and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting.

1.09 PROJECT / FIELD CONDITIONS

A. Protect building, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from roofing operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

C. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

1. Store all materials prior to application at temperatures between 60 and 90 deg. F (16 and 32 deg C).

2. Apply coatings within range of ambient and substrate temperatures recommended by manufacturer. Do not apply materials when air temperature is below 50 or above 110 deg. F (10 or above 43 deg C).

3. Do not apply roofing in snow, rain, fog, or mist.

D. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

E. Owner will occupy portions of building immediately below roofing area. Conduct roofing so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

1.10 WARRANTY

A. Manufacturer's Warranty: Roof System Manufacturer's standard form in which Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within warranty period, as follows.

1. Form of Warranty: Manufacturer's standard warranty form.

2. Scope of Warranty: Work of this Section and including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.

3. Wind Speed: 90 m.p.h.

4. Warranty Period: 30 years from date of completion.

B. Manufacturer Inspection Services: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner's warranty rights. The cost of manufacturer's inspections is included in the Contract Sum.

1. Inspections to occur in following years: 2, 5, 10, 15, 20 & 25 following completion.

C. Installer Warranty: Installer's warranty signed by Installer, as follows.

1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.

2. Scope of Warranty: Work of this Section.

3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: The roof system specified in this Section is based upon products of Tremco CPG Inc, www.tremcoroofing.com that are named in other Part 2 articles. Provide specified products or comparable products of one of the following.

1. Tremco CPG Inc., Basis of design.

2. Kemper.

3. Sika.

B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. General: Provide roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

1. No asphalt mastic is permitted on this project. Use only polyurethane-compatible materials as approved by manufacturer.

C. Roof Assembly to consist of:

1. 24-mil slip-resistant top coat & embedded granules on roof field.

2. 32-mil black polyurethane top coat on field and flashings.

3. 48-mil polyurethane base coat on field and flashings, with fully embedded polyester reinforcing fabric.

4. 60-mil SBS-modified base ply adhered in 32-mil polyurethane adhesive.

5. 1/2-inch Dens Deck Prime cover board in low rise foam adhesive.

6. Tapered polyisocyanurate insulation in low rise foam adhesive.

7. 118-mil SBS-modified vapor retarder over primed existing concrete deck.

D. Roofing System Design: Provide roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency in accordance with ANSI/FM 4474, UL 580, or UL 1897, and to resist uplift pressures.

1. Zone 1 (Field-of-Roof) Uplift Pressure: 52.8 psf.

2. Zone 2 (Perimeter) Uplift Pressure: 9.6 psf, located within 10 ft. of roof perimeter.

3. Zone 3 (Corner) Uplift Pressure: 94.8 psf, located within 30 ft. of outside corners.

E. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to ANSI/SPRI ES-1.

1. Design Pressure: 94.8 psf.

F. Flashings: Comply with requirements of Division 07 Sections "Sheet Metal Flashing and Trim" and "Manufactured Roof Specialties." Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:

1. FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings.

2. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.

3. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.

G. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

2.03 MATERIALS

A. General: Roofing materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system.

B. General: Provide adhesive and sealant materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2.04 SHEET MATERIALS

A. Base-Ply Sheet:

1. SBS-modified asphalt coated composite polyester / fiberglass/fiberglass mat reinforced high tensile strength base sheet, ASTM D4601 Type II.

    a. Basis of design product: Tremco, BURmastic Composite Ply HT.

    b. Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 165 lbf/in (725 N); Cross machine direction, 150 lbf/in (660 N).

    c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 260 lbf (1150 N); Cross machine direction, 230 lbf (1120 N).

    d. Thickness, minimum, ASTM D5147: 0.060 inch (1.5 mm).

2.05 FLUID-APPLIED ROOFING MEMBRANE

A. Polyurethane Elastomeric Fluid-Applied System: Two-coat reinforced fluid-applied roofing membrane formulated for application over prepared existing roofing substrate.

1. Base Coat:

    a. Polyurethane Roof Coating System Base Coat: Single-part moisture-curing, for use with a compatible top coat.

        1) Basis of design product: Tremco, AlphaGuard MTS Base Coat.

        2) Combustion Characteristics, UL790: Maintains combustion characteristics of existing roof system.

        3) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 50 g/L.

        4) Accelerated Weathering, 5000 hours, ASTM G154: Pass.

        5) Hardness, Shore A, minimum, ASTM D2240: 85.

        6) Solids, by volume, ASTM D2697, minimum: 87 percent.

        7) Minimum Thickness, Base Coat on Smooth Surface: 48 mils wet.

2. Top Coat:

    a. Polyurethane roof coating system top coat, low odor low VOC single-part, for application over compatible base coat.

        1) Basis of design product: Tremco, AlphaGuard MT Top Coat.

        2) Combustion Characteristics, UL790: Maintains combustion characteristics of existing roof system.

        3) Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 50 g/L.

4) Solar Reflectance Index (SRI), ASTM C1549: 86 percent.

5) Accelerated Weathering, 5000 hours, ASTM G154: Pass.

6) Hardness, Shore A, minimum, ASTM D2240: 85.

7) Solids, by volume, ASTM D2697: 87.

8) Minimum Thickness: 48 mils wet over cured base coat.

9) Minimum Thickness, Slip-Resistant Coat: 24 mils wet.

10) Color: Black.

3. Reinforcing Fabric:

a. Polyester Reinforcing and Protection Fabric: 100 percent stitch-bonded mildew-resistant polyester fabric intended for reinforcement of compatible fluid-applied membranes and flashings and as a protection layer under pavers or stone aggregates.

1) Basis of design product: Tremco, Permafab.

2) Tensile Strength, Minimum, ASTM D5034 (2-inch): MD - 110 lbs. (49.8 kg); XMD - 60 lbs. (27.2 kg) avg.

3) Elongation, Minimum, ASTM D5034 (1-inch): MD - 25 percent; XMD - 100 percent.

4) Tear Strength, Minimum, ASTM D5587: MD - 20 lbs. (9.0 kg) avg; XMD - 20 lbs. (9.0 kg) avg.

5) Weight: 3 oz./sq. yd (102 g/sq. m).

4. Primers:

a. Primer for Asphaltic and Single-Ply Membranes: Water-based, polymer-modified quick-dry low odor primer.

1) Basis of design product: Tremco, AlphaGuard WB Primer.

2) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 1 g/L.

3) Solids, by weight: 70 percent.

b. Primer for Masonry Surfaces: Two-part high-solids epoxy-penetrating low-odor primer for masonry and concrete surfaces.

1) Basis of design product: Tremco, AlphaGuard C-Prime.

2) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

3) Solids, by weight: 100 percent.

c. Primer for Non-Porous Surfaces: Single-part, water based primer to promote adhesion of urethanes to metals, PVC and other non-porous surfaces.

1) Basis of design product: Tremco, AlphaGuard M-Prime.

2) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 22 g/L.

3) Nonvolatile Content, minimum, ASTM D2369: 5 percent.

4) Density at 77 deg F (25 deg C): 8.3 lb./gal (1kg/L).

d. Primer for Intercoat and Substrate Adhesion: Single-part, quick-drying primer to promote adhesion of urethane products to previous urethane coats and to other approved surfaces.

1) Basis of design product: Tremco, Geogard Primer.

2) Volatile Organic Compounds (VOC), maximum, ASTM D3960: 100 g/L.

3) Coverage Rate, 400 sq. ft/ gal. (10 m2/ L): 4 mils (0.10 mm) wet.

2.06 ADHESIVE MATERIALS

A. Base-Ply Sheet Adhesive:

1. Cold-applied bio-based low odor urethane roofing adhesive, two-part, USDA BioPreferred, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, POWERply Endure BIO Adhesive TF.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3690: 0 g/L.

c. Low Temperature Flexibility, ASTM D2240: Pass at -30 deg F (-34 deg C).

d. Solids, by Volume, ASTM D2697: 100 percent.

e. Biobase Content, Minimum, ASTM D6866: 70 percent.

2.07 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with existing roofing system and fluid-applied roofing system.

B. Joint Sealant: Elastomeric joint sealant compatible with applied coating, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

    a. Basis of design product: Tremco, TremSEAL Pro.

    b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

    c. Hardness, Shore A, ASTM C661: 40.

    d. Adhesion to Concrete, ASTM C794: 35 pli.

    e. Tensile Strength, ASTM D412: 350 psi (2410 kPa).

    f. Color: Black.

C. Stripping Adhesive / Sealer:

1. Seam Sealer: Aromatic polyurethane sealer, single-component, high solids, moisture curing, formulated for compatibility and use with a variety of roofing and flashing substrates.

    a. Basis of design product: Tremco, GEOGARD Seam Sealer.

    b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 189 g/L.

    c. Tensile Strength, ASTM D412: 270 psi (1860 kPa).

    d. Tear Strength, ASTM D412: 35 pli (6.13 kNm).

    e. Elongation, ASTM D412: 220 percent.

    f. Color: Gray.

D. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.08 VAPOR RETARDER/AIR BARRIER

A. Vapor Retarder Sheet:

1. SBS/SIS/SEBS-modified asphalt-coated glass-fiber reinforced sheet, smooth surfaced, designed for heat-welded applications, ASTM D6163 Type I Grade S.

    a. Basis of design product: Tremco, POWERply Standard Smooth HW (Heat Weld).

    b. Tensile Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: 70 lbf/in (12 kN/m) machine direction; 50 lbf/in (8 kN/m) cross-machine direction.

c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: 100 lbf (445 N) machine direction; 80 lbf (400 N) machine direction.

d. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147: 4 percent machine direction; 4 percent cross-machine direction.

e. Low Temperature Flex, ASTM D5147: -30 deg. F (-23 deg. C).

f. Thickness, ASTM D5147: 0.118 inch (3.0 mm).

B. Vapor Retarder Primer:

1. Asphalt primer, water-based, polymer modified.

a. Basis of design product: Tremco, TREMprime WB.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 2 g/L.

c. Color: Brown/black.

2.09 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/8 inch per 12 inches (1:96) unless otherwise indicated.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.

B. Roof Insulation:

1. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.

a. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).

2.10 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with built-up roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.

C. Roof Insulation Adhesive:

1. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.

    a. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.

    b. Flame Spread Index, ASTM E84: 10.

    c. Smoke Developed Index, ASTM E84: 30.

    d. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

    e. Tensile Strength, minimum, ASTM D412: 250 psi (1720 kPa).

    f. Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.50 kN/m).

    g. Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.

D. Wood Cant Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."

E. Tapered Edge Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.

F. Cover Board:

1. Gypsum panel, glass-mat-faced, primed, ASTM C1177/C1177M.

    a. Basis of design product: GP Gypsum DensDeck Prime.

    b. Thickness: 1/2 inch (12 mm).

2.11 WALKWAYS

A. Walkway Materials:

1. Polyurethane Top Coat, Slip-Resistant: Second top coat with broadcast slip-resistant aggregate.

    a. Basis of design product: Tremco, AlphaGuard Top Coat Slip-Resistant.

    b. Minimum Thickness: As indicated in Part 2 product listing; over cured top coat.

    c. Ceramic granules: 10 to 15 lbf/100 sq. ft.

    d. Color: As selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Concrete Deck:

a. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.

b. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation once unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove existing roofing and protect existing building in accordance with requirements of Division 07 Section "Preparation for Re-Roofing."

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

C. Protect existing roofing system that is indicated to remain, and adjacent portions of building and building equipment.

1. Comply with warranty requirements of existing roof membrane manufacturer.

2. Mask surfaces to be protected. Seal joints subject to infiltration by coating materials.

3. Limit traffic and material storage to areas of existing roofing membrane that have been protected.

4. Maintain temporary protection and leave in place until replacement roofing has been completed.

D. Shut down air intake equipment in the vicinity of the Work in coordination with the Owner. Cover air intake louvers before proceeding with re-coating work that could affect indoor air quality or activate smoke detectors in the ductwork.

1. Verify that rooftop utilities and service piping affected by the Work have been shut off before commencing Work.

E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs

specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. Do not permit water to enter into or under existing membrane roofing system components that are to remain.

3.03 MEMBRANE ROOFING INSTALLATION, GENERAL

A. Install roofing membrane according to roofing manufacturer's written instructions.

1. Commence installation of roofing in presence of manufacturer's technical personnel.

B. Coordinate installation of roofing so insulation and other components of roofing not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Substrate-Joint Penetrations: Prevent fluid-applied materials and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

3.04 VAPOR-RETARDER INSTALLATION

A. Vapor Retarder Sheet, General: Completely seal vapor retarder/air barrier at terminations, obstructions, and penetrations to prevent air movement into roofing system. Seal vapor retarder/air barrier to air barrier in adjacent construction at perimeter of roofing system.

B. Torch-Applied SBS Modified Sheet Vapor Retarder: Install one lapped vapor retarder course and torch-apply to substrate, according to roofing system manufacturer's written instructions.

1. Installer to follow all CERTA guidelines and procedures for torch-applied roofing materials.

2. Any temporary seals at vertical transitions or penetrations to be made using polyurethane seam sealer.

3.05 INSULATION INSTALLATION

A. Comply with roofing manufacturer's written instructions for installing roof insulation.

B. Coordinate installing membrane roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

C. Tapered Insulation and Crickets: Install tapered insulation under area of roofing to conform to slopes indicated.

1. Where saddles or crickets are indicated or required to provide positive slope to drain, make slope of crickets minimum of two times the roof slope.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (70 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

1. Tapered Insulation System for Flat Roof Deck: Install insulation as follows:

a. Minimum Continuous Insulation R-value: Not less than R-30.

2. Insulation Drain Sumps: Tapered insulation sumps, not less than 2 by 2 ft (600 by 600 mm), sloped to roof drain; sump to maximum depth of not more than 1 inch (25 mm) less than the Project-stipulated continuous insulation thickness based upon code requirements.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together.

1. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover in place.

3.06 BASE-PLY SHEET INSTALLATION

A. Install base sheet starting at low point of roofing. Align base sheet without stretching. Shingle side laps of base a minimum of 4 inches (100 mm). Shingle in direction to shed water. Extend base sheets over edges and terminate above cants.

1. Embed base sheet in cold-applied membrane adhesive applied at rate required by roofing manufacturer.

2. Seal base ply at all transitions and penetrations with polyurethane seam sealer.

B. Install stripping according to roofing manufacturer's written instructions where metal flanges and edgings are set on roofing.

1. Flashing Sheet Stripping: Install flashing sheet stripping in specified cold adhesive and extend onto roofing membrane.

C. Roof Drains: Install base-ply sheet in cold adhesive around drain bowl. Base sheet must be installed so that it will be under compression from the clamping ring. Install base coat, fabric reinforcement, and top coat over base sheet. Install drain clamping ring and strainer.

3.07 FLUID-APPLIED FLASHING APPLICATION

A. Fluid-Applied Flashing and Detail Base Coat Application: Complete base coat and fabric reinforcement at parapets, curbs, penetrations, and drains prior to application of field of fluid-applied membrane. Apply base coat in accordance with manufacturer's written instructions.

1. Extend coating minimum of 8 inches (200 mm) up vertical surfaces and 4 inches onto horizontal surfaces.

2. Back roll to achieve minimum coating thickness indicated on Part 2 product listing unless greater thickness is recommended by manufacturer; verify thickness of base coat as work progresses.

3. Reinforcing Fabric: Embed fabric reinforcement into wet base coat. Lap adjacent flashing pieces of fabric minimum 3 inches (75 mm) along edges and 6 inches (150 mm) at end laps.

a. Roll surface of fabric reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

4. Roll surface of fabric reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

5. Roof Drains: Set 30 by 30 inch (760 by 760 mm) square metal flashing in bed of compatible mastic/adhesive sealer on roofing base-ply sheet. Cover metal flashing with stripping ply and extend a minimum of 6 inches (150 mm) beyond edge of metal flashing. Allow to cure.

a. Apply base coat and immediately install target piece of fabric reinforcement into wet base coat, extend into drain bowl and roll to fully embed and saturate fabric. Apply top coat after base coat has cured.

b. Following application and curing of fluid-applied roofing membrane, install clamping ring and strainer. Replace broken drain ring clamping bolts.

6. Allow base coat to cure prior to application of top coat.

3.08 FLUID-APPLIED MEMBRANE APPLICATION

A. Base Coat: Apply base coat to field of membrane in accordance with manufacturer's written instructions.

1. Apply base coat on prepared and primed surfaces and spread coating evenly.

2. Back roll to achieve minimum coating thickness indicated on Part 2 product listing unless greater thickness is recommended by manufacturer; verify thickness of base coat as work progresses.

3. Reinforcing Fabric: Embed fabric reinforcement into wet base coat. Lap adjacent flashing pieces of fabric minimum 3 inches (75 mm) along edges and 6 inches (150 mm) at end laps.

a. Roll surface of fabric reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

4. Roll surface of fabric reinforcing to completely embed and saturate fabric. Leave finished base coat with fabric free of pin holes, voids, or openings.

5. Allow base coat to cure prior to application of top coat.

B. Top Coat: Apply top coat to field of membrane and flashings uniformly in a complete, continuous installation.

1. Prime base coat prior to application of top coat if top coat is not applied within 72 hours of the base coat application, using manufacturer's recommended primer.

2. Apply top coat extending coating up vertical surfaces and out onto horizontal surfaces. Install top coat over field base coat and spread coating evenly.

3. Back roll to achieve minimum coating thickness indicated on Part 2 product listing unless greater thickness is recommended by manufacturer; verify thickness of base coat as work progresses.

4. Avoid foot traffic on new fluid-applied membrane for a minimum of 24 hours.

3.09 SLIP RESISTANT TOP COAT INSTALLATION

A. General: Install slip resistant walkway top coat according to roofing manufacturer's written instructions.

1. Install at following locations:

a. On entire horizontal field of roof.

B. Slip-Resistant Walkway Topcoat: Apply walkway second topcoat following application and curing of initial top coat.

1. Prime first top coat prior to application of walkway top coat if walkway top coat is not applied within 72 hours of the first top coat application, using manufacturer's recommended primer.

2. Apply walkway topcoat and back roll to achieve minimum coating thickness indicated on Part 2 product listing unless greater thickness is recommended by manufacturer; verify thickness of base coat as work progresses.

3. Broadcast Slip-Resistant Top Coat Aggregate in wet top coat at rate indicated in Part 2 product listing or as otherwise recommended by coating manufacturer.

    a. Back roll aggregate and top coat creating even dispersal of aggregate.

4. Remove masking immediately.

3.10 FIELD QUALITY CONTROL

A. Roof Inspection: Contractor shall engage roofing system manufacturer's technical personnel to inspect roofing installation, and submit report to the Architect. Notify Architect 24 hours in advance of dates and times of inspections. Inspect work as follows:

1. Upon completion of preparation of first component of work, prior to application of re-coating materials.

2. Following application of re-coating to flashings and application of base coat to field of roof.

3. Upon completion of re-coating but prior to re-installation of other roofing components.

4. Additional inspections as follows:

    a. Observe first two (2) days of installation.
    b. Observe two (2) other non-sequential full days of installation selected by the Consultant.
    c. If work of other trades may occur after roofing is installed, review the temporary protective coverings for compliance with manufacturer’s recommendations, guidelines for best practices.
    d. Inspect completed installations and provide written acceptance for each completed installation; and
    e. Review the post completion infrared scan of the completed roof areas and make a written recommendation on the impact (if any) of the results on the Warranty.
    f. Inspect the work during the acceptance walk of this project with the Contractor, Installer, Campus, Consultant and the Fund.
    g. In addition, after an inspected portion of the system is worked upon in this Contract by other trades or otherwise exposed to damage from the work of other trades, the advisor shall inspect the system again, upon request of the Consultant.
    h. All the above inspections shall be performed and completed prior to issuing any Warranty.

B. Repair fluid-applied membrane where test inspections indicate that they do not comply with specified requirements.

C. Prior to final acceptance walkthrough with Owner, Contractor shall engage a firm experienced in roof inspection to scan the roofs with the infrared camera. Spray paint the exact contours of any and all moisture laden areas, if any, on the roof surface. During the survey, use a nuclear moisture detector to verify the accuracy of the infrared camera and to check questionable anomalies. Use the nuclear meter to detect moisture, if any, that is located deep in the roofing system. Provide a computer generated roof plan to scale showing all pertinent roof top equipment and the locations, square footages, and contours of all moisture laden areas, if any. If required, provide corrective repairs and replacement roof systems when directed by the Consultant.

D. Arrange for additional inspections, at Contractor's expense, to verify compliance of replaced or additional work with specified requirements.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove coating that does not comply with requirements, repair substrates, and reapply coating.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, exterior penetrations, and other items indicated in Schedule.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 077123 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

F. CDA A4050 - Copper in Architecture - Handbook; current edition.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with silicone modified polyester coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.
2. Color: To match finish of adjacent aluminum-framed storefront system.

B. Terne Coated Stainless Steel: 28-gauge, 0.0156-inch (0.40 mm) ASTM A666 Type 304 alloy core material with 0.092 lb/sq ft (0.45 kg/sq m) terne alloy coating on both sides of core metal.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 GUTTERS AND DOWNSPOUTS

A. See Section 077123 for manufactured gutters and downspouts.

B. Seal metal joints.

2.04 Flashing

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.05 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Fenestration Perimeter Flashing Attachments: Two-piece flashing receiver and clip of extruded aluminum, at least 0.045 inch (1.14 mm) thick, for attaching flashing at perimeter of exterior wall fenestration openings.

1. Provide flashing receiver profile appropriate for flashing applications.

F. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

A. Comply with drawing details.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:

F. Seal metal joints watertight.

G. Secure gutters and downspouts in place with concealed fasteners.

END OF SECTION

SECTION 077123 - MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Galvanized steel gutters and downspouts.

1.02 RELATED REQUIREMENTS
A. Section 073126 - Slate Shingles.

B. Section 076200 - Sheet Metal Flashing and Trim.

C. Section 077200 - Roof Accessories: Electric heating cable in gutters.

1.03 REFERENCE STANDARDS
A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.04 SUBMITTALS
A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 6 inch (152 mm) long illustrating component design, finish, color, and configuration.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Gutters and Downspouts:

1. ATAS International, Inc: www.atas.com/#sle.
2. Cheney Flashing Company: www.cheneyflashing.com/#sle.
3. Drexel Metals Inc: www.drexmet.com/#sle.
4. Hickman Edge Systems: www.hickmanedgesystems.com/#sle.
5. Metal-Era Inc: www.metalera.com/#sle.

2.02 MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.

2.03 COMPONENTS

A. Gutters: SMACNA semi-circular style profile.

B. Downspouts: SMACNA corrugated round profile.

C. Anchors and Supports: Profiled to suit gutters and downspouts.

1. Anchoring Devices: In accordance with SMACNA requirements.
2. Gutter Supports: Brackets.
3. Downspout Supports: Brackets.

D. Fasteners: Galvanized steel.

2.04 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 1/4 inch per foot (6.4 mm/m) .

C. Connect downspouts to downspout boots at existing boot locations. Seal connection watertight.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Snow guards.

B. Roof snow and ice melting system.

1.02 RELATED REQUIREMENTS

A. Section 077100 - Roof Specialties: Other manufactured roof specialty items.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard channel, set in brackets or posts, with optional plates and metal trim to match roof.

1. Extruded Aluminum Channel: Manufacturer's standard shape; with slot for insertion of metal trim matching roof.
2. Supplemental Plates and Clips: Attached to horizontal component; match finish of pipe, tube, rod, or channel.

3. Bracket Base Plate: Shaped to fit roof tile, with integral sealant pocket and factory applied sealant; match bracket material.
   a. Finish: Mill finish.

2.02 Roof Snow and Ice Melting Systems

A. Roof Snow and Ice Melting Systems: Self-regulating heating cable system for gutter applications to melt snow and ice.

1. Application: Shingle roofing system with gutter.
2. Provide cable spacing and number of heating circuits and accessories in accordance with manufacturer's written requirements.
3. **Roof Snow and Ice Melting System is to be provided by Electrical Contractor. Refer to electrical drawings for system specifications. The General Construction Contractor is to coordinate activities related to roofing and gutters with other trades to ensure proper sequencing and installation of work across multiple trades.**

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sprayed fire-resistive materials (SFRM).

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Evaluation reports.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Pyrocrete 40 (Exterior) Pyrolite 15 (Interior).

   b. Grace, W. R. & Co. - Conn.; Grace Construction Products; Monokote MK-6 Series (Interior) Monokote Z106/HY (Exterior).

   c. Isolatek International; Cafco 300 (Interior) Cafco Blaze-Shield HP (Exterior).

   d. Southwest Fireproofing Products Co.; Type 5EF (Interior) Type 7GP (Exterior).

2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Bond Strength: Minimum 150-lbs/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736 for non-high-rise classifications, minimum 430 lbs/sq. ft. high-rise.
4. Density: Not less than 15 lb/cu. ft. and 22 lb/cu. ft. as specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
6. Combustion Characteristics: ASTM E 136.
7. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 10 or less according to ASTM E 84.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21 or rating of 10 according to ASTM D 3274 when tested according to ASTM D 3273.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer.

C. Bonding Agent: Product approved by fireproofing manufacturer

D. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

D. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

3.4 FIELD QUALITY CONTROL

A. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

B. Prepare test and inspection reports.

3.5 CLEANING AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Repair fireproofing damaged by other work before concealing it with other construction.

C. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION

SECTION 078400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Firestopping systems.

1.02 RELATED REQUIREMENTS
A. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS
A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

C. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

D. ITS (DIR) - Directory of Listed Products; Current Edition.

E. FM (AG) - FM Approval Guide; Current Edition.

F. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

G. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS
A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE
A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:

1. 3M Fire Protection Products; www.3m.com/firestop/#sle.
2. A/D Fire Protection Systems Inc; www.adfire.com/#sle.
3. CEMCO; HOTROD Type-X Compressible Firestopping: www.cemcosteel.com/#sle.
4. Everkem Diversified Products, Inc; Intumescent Fire-Rated Putty Pads: www.everkemproducts.com/#sle.
5. Fire Shield, LLC; Barri-Ring: www.fireshieldlv.com/#sle.
6. Grabber Construction Products, Inc; GrabberGard EFC: www.grabberman.com/#sle.
7. Hilti, Inc; www.hilti.com/#sle.
8. HoldRite, a Brand of Reliance Worldwide Corporation; HydroFlame: www.holdrite.com/#sle.
9. MarinoWARE; www.marinoware.com/#sle.
10. Nelson FireStop Products; www.nelsonfirestop.com/#sle.
11. Passive Fire Protection Partners; Firestop 3600EX: www.firestop.com/#sle.
12. RectorSeal, a CSW Industrials Company; Metacaulk 150+ General Purpose Firestop Sealant: www.rectorseal.com/firestop-solutions/#sle.
13. Specified Technologies Inc; www.stifirestop.com/#sle.
14. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

1. Movement: Provide systems that have been tested to show movement capability as indicated.
2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

B. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

J. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.03 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
7. Sample product warranty.
8. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

F. Installer's qualification statement.

G. Executed warranty.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver sufficient samples to manufacturer for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints:
   a. Seal the following joints:
      1) Wall expansion and control joints.
      2) Joints between doors, windows, and other frames or adjacent construction.
      3) Joints between different exposed materials.
2. Interior Joints:
   a. Seal the following joints:
      1) Joints between door frames and window frames and adjacent construction.
      2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
      3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
      4) Where otherwise indicated on drawings.
3. Do Not Seal:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be covered with expansion joint cover assemblies.
   c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
   d. Joints where sealant installation is specified in other sections.

B. Type JS-1 - Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

1. Type JS-2 - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane traffic-grade sealant.

C. Type JS-3 - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Type JS-4 - Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.
2. Type JS-5 - Floor Joints in Wet Areas: Nonsag polyurethane traffic-grade sealant suitable for continuous liquid immersion.
3. Type JS-6 - Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear.
4. Type JS-4 - In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, and laboratories; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

A. Type JS-1 - Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by Architect from manufacturer's full range.
5. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
6. Products:
   a. Dow; DOWSIL 756 SMS Building Sealant: www.dow.com/#sle.
   b. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com/#sle.

B. Type JS-6 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Color: Clear.
2. Products:
   a. Everkem Diversified Products, Inc; TruSil 100: www.everkemproducts.com/#sle.
   b. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.
   c. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.

C. Type JS-3 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
4. Products:
   a. Pecora Corporation; DynaFlex: www.pecora.com/#sle.
   b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.

D. Type JS-5 - Nonsag Traffic-Grade Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 20 to 30, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.

E. Type JS-4 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.

1. Color: To be selected by Architect from manufacturer's full range.
2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
3. Products:
   a. Everkem Diversified Products, Inc; SilTex 40: www.everkemproducts.com/#sle.
   b. Pecora Corporation; AC-20 +Silicone: www.pecora.com/#sle.
   c. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
   d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.

2.04 SELF-LEVELING JOINT SEALANTS

A. Type JS-2 - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).

2.05 ACCESSORIES

A. Sealant Backing Rod, Closed-Cell Type:

1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
2. Size: 25 to 50 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

SECTION 080352 - HISTORIC TREATMENT OF WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes historic treatment of wood windows in the form of the following:

1. Repairing wood windows and trim.
2. Reglazing.

B. Related Requirements:

1. Section 060312 "Historic Wood Repair" for repair of historic wood trim.
2. Section 099113 “Exterior Painting” for painting of exterior wood surfaces.

1.2 DEFINITIONS

A. Window: Includes window frame, sash, hardware, trim, storm window, and exterior and interior shutters unless otherwise indicated by context.

B. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.

C. Interior Trim: Casing, stool, and apron.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review minutes of Preliminary Historic Treatment Conference that pertain to historic treatment of wood windows.
2. Review methods and procedures related to historic treatment of wood windows.
3. Determine location of in-place mockups.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.5 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: A qualified historic wood window specialist, experienced in repairing, refinishing, and replacing wood windows in whole and in part. Experience only in fabricating and installing new wood windows is insufficient experience for wood-window historic treatment work.

1.6 MOCK-UPS

A. See Section 014000 – Quality Requirements for additional requirements.

B. Restore existing wood window in-place following requirements established elsewhere in this specification.

C. Locate mock-up for each level of repair in locations directed by Architect.

PART 2 - PRODUCTS

2.1 HISTORIC TREATMENT OF WOOD WINDOWS, GENERAL

A. Quality Standard: Comply with applicable requirements in Section 12, "Historic Restoration Work," and related requirements in AWI/AWMAC/WI's "Architectural Woodwork Standards" for construction, finishes, grades of wood windows, and other requirements unless otherwise indicated.

1. Exception: Industry practices cited in Section 12, Article 1.5, Industry Practices, of the Architectural Woodwork Standards do not apply to the work of this Section.

2.2 WOOD-REPLACEMENT MATERIALS

A. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood component or assembly unless otherwise indicated.

2.3 WOOD-REPAIR MATERIALS

A. Wood-Patching Compound: Two-part epoxy-resin wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Abatron, Inc.
    b. ConServ Epoxy LLC.
    c. Gougeon Brothers, Inc.
    d. Polymeric Systems, Inc.
    e. Protective Coating Company.
    f. System Three Resins, Inc.

2.4 GLAZING MATERIALS

A. Glazing Systems:

1. Traditional Glazing Products: Glazing points and oil-based glazing putty or latex glazing compound. Tint to required color according to manufacturer's written instructions.

2.5 HARDWARE

A. Window Hardware: Existing window operating mechanisms installed on interior side of windows are to be salvaged and turned over to Owner. Retain and repair existing pivoting hardware within existing window sashes and jambs.

B. Securing Historic Wood Sashes: Existing wood sashes are to be secured in place by installation of new trim elements indicated on drawings. Fasten new trim elements to existing wood head and sill pieces using 15 gauge 3d steel finish nails.

2.6 MISCELLANEOUS MATERIALS

A. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.

B. Adhesives: Wood adhesives for exterior exposure, with minimum 15- to 45-minute cure at 70 deg F, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair.

C. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.
3. Use concealed fasteners for attaching items to other work unless exposed fasteners are unavoidable or the existing fastening method.
4. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
5. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

D. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B 633 for SC 3 (Severe) service condition.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean wood windows of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

B. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.

3.2 HISTORIC TREATMENT OF WOOD WINDOWS, GENERAL

A. General: In treating historic items, disturb them as minimally as possible and as follows:

1. Stabilize and repair wood windows to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
2. Use mechanical means to remove coatings. Remove coatings that are loose or fail to adhere to wood substrate when scraped using hand tools.

3. Repair items in place where possible.
4. Install temporary protective measures to protect wood window work that is indicated to be completed later.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as wire brushing or power tools except as approved by Architect.

C. Repair Wood Windows: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood windows by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood windows by limited replacement matching existing material.

D. Protection of Openings: Where sash or windows are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.

3.3 WOOD WINDOW PATCH-TYPE REPAIR

A. General: Patch wood members that exhibit depressions, holes, or similar voids, and that have limited amounts of rotted or decayed wood.

1. Treat wood members with wood consolidant before applying patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and unable to absorb more. Allow treatment to harden before filling void with patching compound.
2. Remove rotted or decayed wood down to sound wood.

B. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
3. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.

3.4 WOOD WINDOW MEMBER-REPLACEMENT REPAIR

A. General: Replace parts of or entire wood window members at locations indicated on Drawings and where damage is too extensive to patch.

1. Remove broken, rotted, and decayed wood down to sound wood.
2. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member.
3. Secure new wood using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.

B. Repair remaining depressions, holes, or similar voids with patch-type repairs.

3.5 GLAZING

A. Comply with combined written instructions of manufacturers of glass, glazing systems, and glazing materials, unless more stringent requirements are indicated.

B. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.

C. Remove existing glass and glazing where indicated on Drawings, and prepare surfaces for reglazing.

D. Remove glass and glazing from openings and prepare surfaces for reglazing.

E. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.

F. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.

G. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass.

H. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.

I. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless otherwise indicated.

3.6 SECUREMENT OF OPERABLE WINDOWS

A. Secure existing operable wood sash components in place using fasteners specified in this section. Countersink nails and apply wood patching materials and sand to provide smooth, uniform surface.

B. Do not secure existing sash units through means of adhesives or other sealants.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Sound-rated hollow metal doors and frames.

E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2019.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

G. ASTM E413 - Classification for Rating Sound Insulation; 2022.

H. ITS (DIR) - Directory of Listed Products; Current Edition.

I. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.

J. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

K. NAAMM HMMA 850 - Fire-Rated Hollow Metal Doors and Frames; 2014.

L. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2018.

M. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

N. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Door and Frame Assemblies; 2013.

O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

R. UL (DIR) - Online Certifications Directory; Current Edition.

S. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company; www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company; www.assaabloydss.com/#sle.
3. De La Fontaine; HC - Honeycomb Core: www.delafontaine.com/#sle.
4. Dunbarton Corporation; Hollow Metal: www.dunbarton.com/#sle.
5. Republic Doors, an Allegion brand; www.republicdoor.com/#sle.
6. Steelcraft, an Allegion brand; www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory finished.

B. Interior Doors, Non-Fire-Rated:

1. Based on NAAMM HMMA Custom Guidelines:
   a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
   b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
   c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
   d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Vertical steel stiffeners.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
4. Door Face Sheets: Flush.

C. Fire-Rated Doors:

1. Based on NAAMM HMMA Custom Guidelines: Comply with NAAMM HMMA 850 requirements for fire-rated doors.
   a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
   b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.

c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
5. Door Face Sheets: Flush.

D. Sound-Rated Interior Doors:

1. Based on NAAMM HMMA Custom Guidelines:
   a. Comply with guidelines of NAAMM HMMA 865 for Sound Control Hollow Metal Doors and Frames.
   b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
   c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
   d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 45, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Thickness: 1-3/4 inch (44.45 mm).
4. Door Face Sheets: Flush.
5. Sound Seals: Integral, in door and/or frame.
6. Opening Force of Sound-Rated Doors, Non-Fire-Rated: 5 pounds (22.2 N), maximum, in compliance with ADA Standards.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

1. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.

1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.

E. Sound-Rated Door Frames: Full profile/continuously welded type.

1. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.

F. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.

G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

H. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

2.06 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

1. Color: As selected by Architect from manufacturer's full range.

2.07 ACCESSORIES

A. Glazing: As specified in Section 088000, factory installed.

B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Install door hardware as specified in Section 087100.

E. Comply with glazing installation requirements of Section 088000.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 087100 - Door Hardware: Hardware items other than specified in this section.

C. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

G. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface, glass, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Sample warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefronts:

1. Kawneer North America: www.kawneer.com/#sle.
2. Tubelite, Inc: www.tubeliteinc.com/#sle.
3. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
4. YKK AP America, Inc: www.ykkap.com/commercial/#sle.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:

1. Basis of Design: Kawneer North America; Trifab VersaGlaze 451T: www.kawneer.us.
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (51 mm wide by 114 mm deep).

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Medium Stile, Insulating Glazing, Thermally-Broken:

1. Basis of Design: Kawneer North America; 500T Insulpour;.
2. Thickness: 1-3/4 inches (43 mm).

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:

1. Tubelite, Inc.: www.tubeliteinc.com.
2. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
3. YKK AP America, Inc.:www.ykkap.com/commercial.

2.04 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Finish: Superior performing organic coatings.

a. Factory finish all surfaces that will be exposed in completed assemblies.
b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2. Finish Color: As selected by Architect from manufacturer's standard line.
3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7.
   b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
4. Overall U-value Including Glazing: maximum.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Glazing Stops: Flush.
2. Cross-Section: 2 by 4-1/2 inch (51 by 114 mm) nominal dimension.

B. Glazing: See Section 088000.

C. Swing Doors: Glazed aluminum.

1. Thickness: 1-3/4 inches (43 mm).
2. Top Rail: 5 inches (89 mm) wide.
3. Vertical Stiles: 5 inches (89 mm) wide.
4. Bottom Rail: 10 inches (254 mm) wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

B. Color: As selected by Architect from manufacturer's full range.

2.08 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

E. Hinges: Butt type, swing clear; top and bottom.

F. Push/Pull Set: Standard configuration push/pull handles.

G. Exit Devices: Panic type.

H. Door Closers: Concealed overhead.

I. Locks: Dead latch with thumbturn inside ; keyed cylinder outside.

J. Automatic Door Operators and Actuators: See Section 084229.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

1. See Section 084229 for operator and actuator installation requirements.

K. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 088000.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 085413 - FIBERGLASS WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory fabricated fiberglass windows with fixed and operating sash.

B. Glazed by factory.

C. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 072600 - Vapor Retarders: Sealing frames to vapor barrier installed on adjacent construction.

B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022, with Errata (2023).

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

C. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

D. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

E. ASTM E2353 - Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades; 2021.

F. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, anchors, fasteners, glass, internal drainage details, and operating hardware.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, installation requirements.

D. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.

E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:

1. Evidence of AAMA Certification.
2. Evidence of WDMA Certification.
3. Evidence of CSA Certification.
4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

F. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Executed warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 10-year manufacturer warranty covering finish, including degradation or failure due to chemical contact. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer Warranty: Provide 5-year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of vinyl color finish. Complete form in Owner's name and register with manufacturer.

D. Correct defective Work within a ten-year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Windows:

1. Alpen High-Performance Products; Zenith Series Windows: www.thinkalpen.com/#sle.
2. Marvin; Elevate Windows: www.marvin.com/#sle.
3. Pella Corporation; Pella Impervia Windows: www.pellacommercial.com/#sle.

2.02 WINDOW UNITS

A. Fiberglass Windows: Hollow, tubular, multilayer-fiber-reinforced pultruded material; factory fabricated; related flashings, anchorage and attachment devices.

1. Product Type: AP - Awning projected window and FW - Fixed window in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
2. Interior Color: As selected by Architect from manufacturer's full line of colors.
3. Exterior Color: As selected by Architect from manufacturer's full line of colors.
4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

2.03 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:

1. Performance Class (PC): CW.
2. Performance Grade (PG): 40, with minimum design pressure (DP) of 40.0 psf (40, with minimum design pressure (DP) of 1920 Pa).

B. Design Pressure (DP): In accordance with applicable codes.

C. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.

D. Condensation Resistance Factor: CRF of 60, minimum, the lower value of the glass and frame window components and determined in accordance with AAMA 1503.

E. Overall Thermal Transmittance (U-Value): 0.26, maximum, including glazing, measured on window sizes required for this project.

F. Center of Glass Solar Heat Gain Coefficient (SHGC): 0.46; comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.

G. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 pounds per square foot (580 Pa).

H. Air Leakage: 0.01 cfm/sq ft (0.05 L/sec sq m) maximum leakage when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

2.04 COMPONENTS

A. Frames: 2-1/4-inch (57 mm) wide by 3-1/4-inch (83 mm) deep profile; flush glass stops of screw fastened type.

1. Type: Block type.
2. Frame Corners: Mitered and joined with nylon corner locks.

B. Sills: 2-1/4 inch (57 mm) nominal thickness, pultruded fiberglass; sloped for positive wash; fit under sash to 1/2 inch (12 mm) beyond wall face; one piece full width of opening.

C. Operable Sash Weather Stripping: Resilient PVC; permanently resilient, profiled to effect weather seal.

D. Fasteners: Stainless steel.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 GLASS AND GLAZING MATERIALS

A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, krypton filled, bird-friendly, with thermoplastic warm-edge spacer, with glass thicknesses as recommended by manufacturer for specified wind conditions and acoustic rating indicated.

1. Glazing Tape: Closed-cell-foam type with double-sided adhesive.
2. Setting Blocks: Manufacturer's standard.
3. Interior Glass Panel: Tempered glass, 1/8 inch (3 mm) thick.
4. Exterior Glass Panel: Tempered glass, 1/8 inch (3 mm) thick.

2.06 HARDWARE

A. Awning Sash: Zinc die-cast steel worm-gear operator with Painted finish.

1. Operator Linkage, Hinge Slide, and Hinge Arms: 300 series stainless steel.
2. Comply with ASTM E2353 for fall protection.

2.07 FABRICATION

A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.

B. Form weather stop flange to perimeter of unit.

C. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

D. Arrange fasteners to be concealed from view.

E. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

F. Double weatherstrip operable units.

G. Factory glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining water-resistive barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Set sill members and sill flashing in continuous bead of sealant.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install operating hardware.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

3.04 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. CU Standard 281316 – Electronic Safety and Security Systems

1.2 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

    a. Swinging doors.

2. Electrified door hardware.

B. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain the requirements of this Section.

1. Thresholds and weather stripping to be installed under other Sections.
2. Permanent lock cores to be installed by Owner.

C. References

1. NFPA 80 Fire Doors and Windows
2. NFPA 101 Life Safety Code.
3. Building Code of New York State.
4. ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities.
5. ANSI/BHMA Standard A156.1 Butts and Hinges.
6. ANSI/BHMA Standard A156.4 Door Controls – Closers.
7. ANSI/BHMA Standard A156.6 Architectural Door Trim.
8. ANSI/BHMA Standard A156.7 Template Hinge Dimensions.
9. ANSI/BHMA Standard A156.8 Door Controls – Overhead Stops and Holders.
10. ANSI/BHMA Standard A156.13 Mortise Locks and Latches Series 1000.
11. ANSI/BHMA Standard A156.16 Auxiliary Hardware.
12. ANSI/BHMA Standard A156.18 Materials and Finishes.
13. ANSI/BHMA Standard A156.22 Door Gasketing Systems.

14. ANSI/BHMA Standard A156.26 Continuous Hinges.
15. DHI - Door and Hardware Institute.
16. NAAM Standard HMMA 800-96- Hollow Metal Manufacturers Association.
17. NAAM Standard HMMA 831-97 Recommended Hardware Locations for Custom Hollow Metal Doors and Frames.
18. 2010 Standards for State and Local Government Facilities: Title II.

1.3 DEFINITIONS

A. Architectural Hardware Consultant (AHC): A Door and Hardware Institute certified expert in complex architectural openings requiring advanced knowledge of model building codes and safety standards, ADA requirements, access control knowledge and installation expertise.

B. Architectural Hardware Distributor: A company that regularly purchases architectural hardware from manufacturers and specializes in the sale, service and support of that hardware to contractors and/or end users.

C. Company Field Advisor(s): Hardware manufacturers' representatives who are certified in writing by manufacturer to be technically qualified in design, installation, and servicing of products.

D. Installation Supervisor: Designated supervisor/installer, who has a minimum three years' experience in finish hardware installation, and is qualified and responsible to ensure approved finish hardware is installed, adjusted, and operates properly.

1.4 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with the Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference via video conferencing.

B. Keying Conference: Conduct conference at video conferencing.

1. Conference participants shall include Installer's Architectural Hardware Consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

    a. Flow of traffic and degree of security required.
    b. Preliminary key system schematic diagram.
    c. Requirements for access control.
    d. Address for delivery of keys.

1.6 SUBMITTALS

A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions

B. Manufacturer’s installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Product Data: For each type of product.

1. Include construction details, material descriptions, operational descriptions, dimensions of individual components and profiles, and finishes.

E. Shop Drawings: For electrified door hardware.

1. For every hardware set that includes electronic hardware a “Theory of Operation” shall be provided.
2. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access-controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.

1. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings. Include diagrams for power, signal, and control wiring.

F. Samples: For each exposed product in each finish specified, in manufacturer's standard size.

1. Tag Samples with full product description to coordinate Samples with door hardware schedule.

G. Samples for Initial Selection: For each type of exposed finish.

H. Samples for Verification: For each type of exposed product, in each finish specified.

1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch-long Samples for other products.

    a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

2. Tag Samples with full product description to coordinate Samples with door hardware schedule.

I. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit the door hardware schedule concurrently with the submissions of Product Data, Samples, and Shop Drawings. Coordinate the submission of the door hardware schedule with the scheduling requirements of other work to facilitate the fabrication of other work that is critical in the Project construction schedule. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
2. Format: Use the same scheduling sequence and format and the same door numbers as in the door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

J. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner’s Representative’s final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

K. Qualification Data: For Installer and Architectural Hardware Consultant.

L. Product Certificates: For each type of electrified door hardware.

1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

M. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

N. Field quality-control reports.

O. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

5. Ten years for mortise locks and latches.
6. Five years for exit hardware.
7. Ten years for manual surface door closers.
1. Two years for electromechanical door hardware.

1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and employer of workers trained and approved by product manufacturers, as well as an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor and Owner’s Representative about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person experienced in providing consulting services for door hardware installations comparable in material, design, and extent to that indicated for this Project and currently certified by DHI as an Architectural Hardware Consultant (AHC).

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications listed by a testing and inspecting agency that are acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the door's leading edge.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner’s Representative by registered mail or overnight package service.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.3 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

a. Three Hinges: For doors with heights 61 to 90 inches.
b. Plus one hinge for every 30 inches of door height greater than 90 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Widths from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed for all out-swinging lockable doors.

4. Acceptable Manufacturers:

a. Bommer Industries (BO).
b. Hager Companies (HA).
c. McKinney Products (MK). **PREFERRED BRAND**

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy-duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90-minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

    a. Bommer Industries (BO).
    b. Hager Companies (HA). **PREFERRED BRAND**
    c. Pemko Manufacturing (PE).

2.4 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:

    a. McKinney Products (MK) - QC (# wires) Option. **FOR RETROFIT APPLICATIONS ONLY**.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:

    a. Securitron (SU) - EL-CEPT Series.

C. Electric Door Hardware Cords: Provide electric transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Acceptable Manufacturers:

    a. McKinney Products (MK) – QC-C Series. Provide 6” QC-C006P on frame side.

2. Provide one each of the following tools as part of the base bid contract:

    a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney Products (MK) - Connector Hand Tool: QC-R003.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

a. Burns Manufacturing (BU).
b. Door Controls International (DC).
c. Rockwood Manufacturing (RO).
d. Trimco (TC).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years’ experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA).

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Match Facility Restricted Keyway.

D. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:

1. Existing System: Master key or grand master key locks to Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Top Master Key: One (1)
2. Change Keys per Cylinder: Two (2)
3. Master Keys (per Master Key Group): Two (2)
4. Grand Master Keys (per Grand Master Key Group): Two (2)
5. Construction Keys (where required): Ten (10)

F. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. (Typically, exterior doors, doors in construction barriers, office suite doors to corridor, etc.) Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

G. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) – 8200 Series.
b. Lock Trim Design: Sargent LNL.

2.8 INTEGRATED WIEGAND OUTPUT LOCKING DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Mortise Locks: Wiegand output ANSI A156.13, Grade 1, mortise lockset with integrated card reader, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1"

case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3-hour fire rated openings. Available with or without keyed high security cylinder override.

2. Open architecture, hard-wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
3. Integrated reader supports the following credentials:

    a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.

4. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
5. Energy Efficient Design: Provide lock bodies, which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.

    a. Acceptable Manufacturers:

        1) Sargent Manufacturing (SA) – M1 8200 Series.

2.9 LOCK AND LATCH STRIKES

B. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

C. Standards: Comply with the following:

4. Strikes for Mortise Locks and Latches: BHMA A156.13.
5. Strikes for Bored Locks and Latches: BHMA A156.2.
6. Strikes for Auxiliary Deadlocks: BHMA A156.5.
7. Dustproof Strikes: BHMA A156.16.

2.10 ELECTRIC STRIKES

THE USE OF ELECTRIC STRIKES ARE NOT ALLOWED.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
3. Except on fire rated doors and doors with access control, provide exit devices keyed cylinder dogging.
4. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy-duty trim with cold forged escutcheons, beveled edges, and threaded studs for through bolts.
    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide keyed cylinder (Rim or Mortise) as required.
6. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Acceptable Manufacturers:

1. Sargent Manufacturing (SA) - 80 Series. **PREFERRED BRAND**
2. Stanley Precision (PR) - Apex 2000 Series.
3. Von Duprin (VD) - 35A/98 XP Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish. Provide keyed removable feature, stabilizers, and mounting brackets as required.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) - 980S Series. **PREFERRED BRAND**
b. Stanley Precision (PR) - 822 Series.
c. Von Duprin (VD) - 9954 Series.

2.12 INTEGRATED WIEGAND OUTPUT EXIT DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:

a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.

3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.

B. Competitor Alternates Allowed Option>Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.

a. Acceptable Manufacturers:

1) Sargent Manufacturing (SA) – M1 80 Series.

2.13 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as required.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:

a. LCN Closers (LC) - 4040XP Series.
b. Sargent Manufacturing (SA) - 351 Series. **PREFERRED BRAND**

2.14 AUTOMATIC DOOR OPERATORS

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Electrohydraulic Door Operators: Self-contained low-pressure units with rack and pinion design contained within a cast aluminum housing. Door closing speed controlled by independent hydraulic adjustment valves in the sweep and latch range of the closing cycle. Operator is to provide conventional door closer opening and closing forces unless the power

operator motor is activated. Unit is to include an adjustable hydraulic backcheck valve to cushion the door speed if opened violently. Non-handed units for both push and pull side applications.

C. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

D. Standard: Certified ANSI/BHMA A156.19.

1. Performance Requirements:

a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

E. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.

F. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

1. On-off switch to control power to be toggle switch operated.

G. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

H. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

I. Activation Devices: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

J. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

1. Acceptable Manufacturers:

a. Sargent

b. LCN Automatic Operator (LC) - 4640 Series. **PREFERRED BRAND**
c. Norton (NO) – 6000 Series

2.15 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be 6”.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:

    a. Stainless Steel: 300 series, 050-inch thick Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.

4. Acceptable Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

2.16 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy

tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

    a. Rixson Door Controls (RF).
    b. Sargent Manufacturing (SA). **PREFERRED BRAND**
    c. Glynn Johnson (GJ).

2.17 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

1. Acceptable Manufacturers:

    a. National Guard Products (NG).
    b. Pemko Manufacturing (PE).
    c. Reese Enterprises, Inc. (RS).

2.18 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models, the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance

design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:

    a. Securitron (SU) - DPS Series.
    b. Sentrol (SO) – 1078 x Mahogany Brown

B. Wiegand Test Unit: Test unit verifies proper Wiegand output integrated card reader lock installation in the field by testing for proper wiring, card reader data integrity, and lock functionality including lock/unlock, door position, and request-to-exit status. 12 or 24VDC voltage adjustable operating as Fail Safe or Fail Secure.

1. Acceptable Manufacturers:

    a. Sargent Manufacturing (SA) - WT1 Wiegand Test Unit.

2.19 LOCK BOXES

A. The University Fire Marshal's Office administers the university's Knox Box program (exterior lock boxes for emergency rapid entry) and will facilitate obtaining the appropriate Knox Box Application.

B. To comply with local ordinance requirements, Cornell University requires the provision of exterior lock boxes for emergency rapid entry. All new and existing buildings that have fire alarm and/or fire detection systems, which interconnect with the fire department, are to be covered by this standard. Alarm system interconnects include, but are not limited to, municipal fire alarm, radio, telephone leased line, telephone dialer, or central station systems.

C. Lock box for the storage of building keys shall be as follows:

1. Manufacturer: The Knox Company, 846 Production Place, Newport Beach, CA. 92663
2. Model:4400 Surface mount with UL listed Knox Tamper Alert, 1/4" plate steel housing, 5/8" thick steel door with interior gasket seal and stainless-steel door hinge. Vault and lock UL listed. Lock has 1/8" thick stainless-steel dust cover with tamper seal mounting capability. Vault has anti-theft drill resistance hard-plate lock protector. Provide "Elock" option in accordance with local fire department standards.

D. Model and location of lock box shall be prescribed and established by University Fire Marshal's Office in collaboration with the fire department having jurisdiction. Lock boxes shall be installed and affixed to the structure in accordance with the manufacturer's detailed instructions.

2.20 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.21 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXECUTION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

D. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6 and ANSI/DHI A115

E. Wood Doors: Comply with door and hardware manufacturers' written instructions and ANSI/DHI A115-W series.

3.2 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

D. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.
2. Furnish permanent cores to Owner for installation.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Owner’s Representative.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.3 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner's Representative will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's maintenance personnel continued adjustment, maintenance, and removal and replacement of door hardware.

3.7 DOOR HARDWARE SCHEDULE

A. Door Hardware Set No. 1

1 Pair Doors: Exterior from Vestibule RHR/LHR 90° (2) 3'-0"x 7'-0"x 2 ¼" ALD/ALF
Locations: 10040A to have the following:

Description of operation: The door is free for entry/exit during working hours. After hours, the exit device secures the latch. Free egress is always from the secure side.

Threshold, weather stripping, and sweep by manufacturer.
Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish
4 ea.	Hinge	McKinney	TA386xNRPx4 ½ x 4 ½	US32D
2 ea.	Hinge	McKinney	TA386xCQ4xNRPx4 ½ x 4 ½	US32D
1 ea	Closer	Sargent	CPC-351-CPS	26D
1 ea	Exit Device	Sargent	55-NB-8713-Fx862 x ETLxLBR	32D
1 ea	Exit Device	Sargent	55-NB-8702-Fx862 x ETLxLBR	32D
1 ea	Auto Operator	LCN	4642-3071-CUSH	689
2 ea	Actuator	Camden	CM-46/4-WT	630
1ea	Relay	Space Age Electronics	SSU-PAM-1	Gray
2 ea	Door Contact	Securitron	DPS	Gray

B. Door Hardware Set No. 2

1 Pair Doors Exterior from Vestibule RHR/LHR 90° (2) 3'-0"x 7'-0"x 2 ¼" ALD/ALF
Locations: 10041A and 10042A each to have the following:

Description of operation: The door is free for entry/exit during working hours. After hours, the exit device secures the latch. Free egress is always from the secure side.

Threshold, weather stripping, and sweep by manufacturer.

Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish
1 ea.	Hinge	McKinney	TA386xNRPx 4 ½ x 4 ½	US32D
1 ea.	Hinge	McKinney	TA386x CQ4xNRPx 4 ½ x 4 ½	US32D
2 ea	Closer	Sargent	CPC-351-CPS	26D
1 ea	Exit Device	Sargent	55-NB-8713-Fx862 x ETLxLBR	32D
1 ea	Exit Device	Sargent	55-NB-8702-Fx862 x ETLxLBR	32D
2 ea	Door Contact	Securitron	DPS	Gray

C. Door Hardware Set No. 3

1 Pair Doors: Vestibule from Corridor RHR/LHR 90° (2) 3’-0”x 7’-0”x 1 ¾ ” ALD/ALF
Locations: 10040B and 10041B and 10042B each to have the following:

Description of operation: The door is free for entry/exit during working hours. After hours, the exit device secures the latch. Free egress is always from the secure side.

Threshold, weather stripping, and sweep by manufacturer.

Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish
2 ea.	Hinge	McKinney	TA386xNRP 4 ½ x 4 ½	US32D
2 ea	Closer	Sargent	CPC-351-CPS	26D
2 sets	Lever Pull	Sargent	8294xLNL	US32D

D. Door Hardware Set No. 4
1 SGL Door: Room from Corridor RH 90° (1) 3’-0”x 7’-0”x 1 ¾” HMD/HMF
Location: 102B each to have the following:
LH 90° (1) 3’-0”x 7’-0”x 1 ¾” HMD/HMF
Location: 101A each to have the following:

Qty.	Item	Manufacturer	Product	Finish
3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Passage	Sargent	8215 x LNL	630
1ea	Wall Stop	Rockwood	406	US26
3 ea	Silencers	Rockwood	609	Gray

E. Door Hardware Set No. 5

1 SGL Door: Corridor to Room RH 90° (1) 3’-0”, (1) 2’-0”x 7’-0”x 1 ¾ ” HMD/HMF - RATED
Locations: 109, 122 each to have the following:

Description of operation: The door is secure at all times. Entry by presenting credential. Free egress is always from the secure side.

Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish
2 ea.	Hinge	McKinney	TA386xNRPx4 ½ x 4 ½	US32D
1 ea.	Hinge	McKinney	TA386xCC8xNRPx4 ½ x 4 ½	US32D
1 ea	Mortise Lockset-Fail Safe	Sargent	8270 x LNL	630
2 ea	Closer	Sargent	CPC-351-CPS	26D
1 ea	Smoke Gasket	Pemko	S773	BL

F. Door Hardware Set No. 6

1 SGL Door Room from Corridor RH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 105, 108, 109A, 113A, 122A, 128B, 202, 203, 204, 208, 210, 20061B
1 SGL Door Room from Corridor LH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 110, 112, 114, 118, 128D (Rated), 206, 207 each to have the following:

Description of operation: The door is secure at all times. Entry by presenting credential. Free egress is always from the secure side.

Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish
2 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea.	Hinge	McKinney	TA386xCC8xNRPx4 ½ x 4 ½	US32D
1 ea	Mortise Lockset-Fail Safe	Sargent	8270 x LNL	630
1 ea	Closer	Sargent	CPC-351	26D
1ea	Overhead Stop	Rockwood	OH100	US32D
1 ea	Sound Gasket	Pemko	PK55	Gray

G. Door Hardware Set No. 7

1 Pair Doors: Corridor to Room RH 90° (1) 3’-0”+ (1) 2’-0”x 7’-0”x 1 ¾ ” HMD/HMF - RATED
Locations: 113B, 113C, 126A, 126B, 10042E each to have the following:

Qty.	Item	Manufacturer	Product	Finish
6 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
2 ea	Mortise Lockset-Office	Sargent	8255 x130KBx LNL	630
2 ea	Closer	Sargent	CPC-351-CPS	26D
1 ea	Mullion	Sargent	980S Series	
1 ea	Smoke Gasket	Pemko	S773	BL

H. Door Hardware Set No. 8

1 SGL Office from Open Lab RH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 115B, 121A, 121B, 121C, 121D, 121E, 128E

Qty.	Item	Manufacturer	Product	Finish
3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Office	Sargent	8255 x130KBx LNL	630
1ea	Overhead Stop	Rockwood	OH100	US32D
1 ea	Sound Gasket	Pemko	PK55	Gray

I. Door Hardware Set No. 9 –
1 SGL Exterior from Mechanical LH 90° (1) 3’-5”x 4’-3”x 1 ¾ ” HMD/HMF
Locations: 1006D

Qty.	Item	Manufacturer	Product	Finish
3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Storage	Sargent	8204 x LNL	630
1 ea	Closer	Sargent	CPC-351-CPS	26D
1 Set	Weather Seal	Pemko	PK55	Gray

J. Door Hardware Set No. 10
1 SGL Office from Open Lab LH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 104 and 106 each to have the following:

Qty.	Item	Manufacturer	Product	Finish
3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Office	Sargent	8255 x LNL	630
1ea	Wall Stop	Rockwood	406	US26
3 ea	Silencers	Rockwood	609	Gray

K. Door Hardware Set No. 11
1 SGL Door Room from Corridor LH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF- RATED
Locations: 113A
1 SGL Door Room from Corridor RH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF- RATED
Locations: 115C, 116 each to have the following:

Description of operation: The door is secure at all times. Entry by presenting credential. Free egress is always from the secure side.

Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish

3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Fail Safe	Sargent	8270 x LNL	630
1 ea	Closer	Sargent	CPC-351	26D
1ea	Overhead Stop	Rockwood	OH100	US32D
1 ea	Smoke Gasket	Pemko	S88	Gray

L. Door Hardware Set No. 12

1 SGL Corridor to Toilet RH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 10022, 10023
1 SGL Corridor to Toilet LH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 10021, 10024 each to have the following:

Qty.	Item	Manufacturer	Product	Finish
3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Office	Sargent	8255x130KB x LNL	630
1ea	Wall Stop	Rockwood	406	US26
1 ea	Sound Gasket	Pemko	PK55	Gray

M. Door Hardware Set No. 13

1 Pair Doors Lab from MEP RHR/LHR 90° (2) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 20061A each to have the following:

RHR/LHR 90° (1) 3’-0”, (1) 2’-0”x 7’-0”x 1 ¾ ” HMD/HMF
Locations: 10062, 20062, 20063 each to have the following:

Description of operation: The door is secure at all times. Entry by presenting credential. Free egress is always from the secure side.

Card Reader by Div 28
Power Supply: by Div 26

Qty.	Item	Manufacturer	Product	Finish
6 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32

1 ea	Mortise Lockset	Sargent	8270 x LNL	630
1 ea	Mortise Trim	Sargent	8293 x LNL	630
2 ea	Closer	Sargent	CPC-351	26D
1 ea	Auto Flush Bolt	Rockwood	2842	US26
2 ea	Closer	LCN	4510-CUSH	689

N. Door Hardware Set No. 14

1 SGL Corridor to Janitor LH 90° (1) 3’-0”x 7’-0”x 1 ¾ ” HMD/HMF - RATED
Locations: 10061

Qty.	Item	Manufacturer	Product	Finish
3 ea.	Hinge	McKinney	TCA3786 4 ½ x 4 ½	US32
1 ea	Mortise Lockset-Storage	Sargent	8204 x LNL	630
1 ea	Closer	Sargent	CPC-351	26D
1ea	Wall Stop	Rockwood	406	US26
3 ea	Smoke Seal	Pemko	S88	Gray

END OF SECTION

SECTION 088000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Plastic films.

D. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 084313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

E. ASTM C1036 - Standard Specification for Flat Glass; 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

I. GANA (GM) - GANA Glazing Manual; 2022.

J. GANA (SM) - GANA Sealant Manual; 2008.

K. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

L. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

M. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch (305 by 305 mm) in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:

1. Olcastle Building Envelope.
2. Pilkington North America.
3. Trulite Glass & Aluminum Solutions, LLC.
4. Viracon, Inc.
5. Vitro Architectural Glass (Basis-of-Design).

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure:
   a. Positive Design Pressure: 20 psf (958 Pa).
   b. Negative Design Pressure: 22 psf (1,053 Pa).
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
5. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:
2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Type G1 - Insulating Glass Units: Vision glazing, with low-e coating.

1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Total Thickness: 1 inch (25.4 mm).
4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
5. Visible Light Transmittance (VLT): 64 percent, nominal.
6. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.
7. Visible Light Reflectance, Outside: 13 percent, nominal.
8. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
9. Spacer Color: Black.
10. Edge Seal:
11. Color: Black.
12. Purge interpane space with dry air, hermetically sealed.
13. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): Solarban 70; www.vitroglazings.com/#sle.
14. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 70 glass on #2 surface.
    b. Glass: Clear.
15. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
    a. Coating: No coating on inboard lite.
    b. Glass: Clear.

B. Type G2 - Insulating Glass Units: Vision glazing, with low-e coating.

1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Total Thickness: 1 inch (25.4 mm).
4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
5. Visible Light Transmittance (VLT): 64 percent, nominal.
6. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.
7. Visible Light Reflectance, Outside: 13 percent, nominal.

8. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
9. Spacer Color: Black.
10. Edge Seal:
11. Color: Black.
12. Purge interpane space with dry air, hermetically sealed.
13. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): Solarban 70; www.vitroglazings.com/#sle.
14. Outboard Lite: Annelaed float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 70 glass on #2 surface.
    b. Glass: Clear.
15. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
    a. Coating: No coating on inboard lite.
    b. Glass: Clear.

2.05 GLAZING UNITS

A. Type G3 - Monolithic Safety Glazing: Non-fire-rated.

1. Applications:
   a. Glazed lites in doors, except fire doors.
   b. Glazed sidelights to doors, except in fire-rated walls and partitions.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.

2.06 PLASTIC FILMS

A. Type F-3 - Decorative Plastic Film: Polyvinyl butyral (PVB) type.

1. Application: Locations as indicated on drawings.
2. Series Type: Frost.
3. Color: Frost.
4. Thickness Without Liner: 0.002 inch (0.051 mm).
5. Manufacturers:
   a. 3M; DI-NOC Window Film: www.3M.com
   b. Avery Dennison; AX900 Super Cast Series Decorative Window Film - Etchmark : www.averydennison.com.
   c. LLumar, an Eastman Chemical Company; Decorative Window Film, Llumar : www.llumar.com.
   d. XPEL, Inc; DECORATIVE: www.xpel.com.

2.07 GLAZING COMPOUNDS

A. Type GC-1 - Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.

2.08 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

1. Width: As required for application.
2. Thickness: As required for application.
3. Spacer Rod Diameter: As required for application.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 088300 - MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.

1. Annealed float glass.
2. Tempered safety glass.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Procedures, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.05 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.

1. Thickness: 1/4 inch (6.4 mm).
2. Edges: Arrised.
3. Size: 24 inch (610 mm) wide by 36 inch (914 mm) high nominal.

2.02 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

C. Glazing Clips: Manufacturer's standard type.

D. Mirror Attachment Accessories: Stainless steel clips.

E. J-Shape Frame: Aluminum extrusion, 1/2 inch by 1/2 inch by 3/8 inch deep (12.7 mm by 12.7 mm by 9.5 mm deep).

1. Material: Comply with ASTM B221 (ASTM B221M), 6005-T6 alloy and temper.
2. Finish: Anodized, clear.
3. Four-Sided Frame: Mitered joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Installation in Frames:

1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
2. Place setting blocks at one-quarter points with edge block no more than 6 inches (152 mm) from corners.
3. Rest mirrors on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
4. Place glazing tape on free perimeter of mirrors in same manner described above.
5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Trim protruding tape edge.

3.03 CLEANING

A. Remove labels after work is complete.

B. Clean mirrors and adjacent surfaces.

END OF SECTION

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Gypsum sheathing.

D. Cementitious backing board.

E. Gypsum wallboard.

F. Joint treatment and accessories.

G. Noise barriers in gypsum board assemblies.

1.02 RELATED REQUIREMENTS

A. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.

B. Section 072600 - Vapor Retarders: Vapor-impermeable membranes.

C. Section 092216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).

K. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets; 2023.

L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

O. ASTM E413 - Classification for Rating Sound Insulation; 2022.

P. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

Q. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

R. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data:

1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

D. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

B. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.06 Delivery, Storage, and Handling

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:

1. Fire-Resistance-Rated Partitions: UL listed assembly No. U-419; 1 hour rating.
2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum Company; www.americangypsum.com.
2. CertainTeed Corporation; www.certainteed.com.
3. Georgia-Pacific Gypsum; www.gpgypsum.com.
4. Gold Bond Building Products, LLC provided by National Gypsum Company; www.goldbondbuilding.com.
5. USG Corporation; www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   a. Mold resistant board is required at all locations.
3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:
   a. Vertical Surfaces: 5/8 inch (16 mm).

C. Backing Board For Wet Areas: One of the following products:

1. Application: Surfaces behind tile in wet areas, including restrooms and walls at sinks scheduled to receive tile..
2. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
   a. Thickness: 1/2 inch (13 mm).

D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch (13 mm).
3. Edges: Tapered.

E. Glass-Mat Faced (Paperless) Gypsum Board: Sizes to minimize joints in place; ends square cut.

1. Application: Interior side of exterior walls, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
5. Core Type: Regular.
6. Regular Board Thickness: 5/8 inch.
7. Edges: Square.
8. Glass Mat Faced Products:
   a. American Gypsum Company; M-Glass Exterior Sheathing Type X: www.americangypsum.com.
   b. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com.
   c. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing: www.gpgypsum.com.
   d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com.
   e. USG Corporation; Securock Brand UltraLight Glass-Mat Sheathing Firecode X 5/8 in.: www.usg.com.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness 2 inches (50.8 mm).

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: See Section 072500.

D. Vapor Retarder: See Section 072600.

E. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.

1. Types: As detailed or required for finished appearance.
2. Products:
   a. Same manufacturer as framing materials.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.
3. Joint Compound: Setting type, field-mixed.

G. Finishing Compound: Surface coat and primer, takes the place of skim coating.

H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

I. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

3.05 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls scheduled to receive vinyl wall covering.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.07 Protection

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking within stud framing.

B. Section 072100 - Thermal Insulation: Acoustic insulation.

C. Section 078400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.

D. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

H. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as follows:

B. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).

1. Studs: C-shaped with flat faces.
   a. Products:
      1) ClarkDietrich; ProSTUD: www.clarkdietrich.com/#sle.
      2) MarinoWARE; ViperStud Drywall Framing: www.marinoware.com/#sle.
      3) MBA Building Supplies; ProSTUD: www.mbastuds.com/#sle.
      4) R-stud; R-stud: www.rstud.com/#sle.
2. Runners: U-shaped, sized to match studs.
3. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

D. Preformed Top Track Firestop Seal:

1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

E. Non-Loadbearing Framing Accessories:

1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
   a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
3. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
4. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.

5. Fasteners: ASTM C1002 self-piercing self-tapping screws.
6. Anchorage Devices: Powder actuated.

2.02 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Align and secure top and bottom runners at 24 inches (600 mm) on center.

D. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

F. Install studs vertically at spacing indicated on drawings.

G. Align stud web openings horizontally.

H. Secure studs to tracks using crimping method. Do not weld.

I. Stud splicing is not permissible.

J. Fabricate corners using a minimum of three studs.

K. Install double studs at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

L. Coordinate erection of studs with requirements of door frames; install supports and attachments.

M. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

N. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inches (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

END OF SECTION

SECTION 093000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Thresholds.

E. Ceramic accessories.

F. Ceramic trim.

G. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 092116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.

B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.

C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.

D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.

E. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.

F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.

G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2019).

H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.

I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).

J. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

K. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.

L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).

M. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

N. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

O. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.

P. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.

Q. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

R. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.

S. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

T. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

U. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).

V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.

W. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's Qualification Statement:

1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Porcelain Tile: ANSI A137.1 standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Size: As indicated on drawings.
3. Thickness: As indicated on drawings.
4. Surface Finish: As indicated on drawings.
5. Color(s): As indicated on drawings.
6. Pattern: As indicated on drawings.
7. Trim Units: Matching bullnose, cove base, and cove shapes in sizes coordinated with field tile.
8. Products: As indicated on drawings.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Stainless steel, style and dimensions to suit application, set with tile mortar or adhesive.

1. Applications:
   a. Open edges of wall and floor tile.
   b. Inside and outside wall corners.
   c. Thresholds at door openings.
   d. Borders and other trim as indicated on drawings.
2. Manufacturers:
   a. Schluter-Systems (Basis-of-Design): www.schluter.com/#sle.
   b. Blanke Corporation; Blanke - Trims and Profiles: www.blankecorp.com/#sle.
   c. Genesis APS International; www.genesis-aps.com/#sle.
   d. LATICRETE International, Inc; www.laticrete.com/#sle.

B. Thresholds: 2 inches (51 mm) wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.

1. Manufacturers:
   a. Durasein (Basis-of-Design); www.durasein.com/#sle.
   b. Dupont: www.corian.com/#sle.
   c. Formica Corporation: www.formica.com/#sle.
   d. LG Hausys America, Inc: www.lghausysusa.com/#sle.
   e. Wilsonart: www.wilsonart.com/#sle.
2. Thickness: 1/2 inch (12.7 mm).
3. Material: Solid surfacing.
4. Color and Pattern: As indicated on drawings.
5. Applications:
   a. At doorways where tile terminates.

b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. ARDEX Engineered Cements; www.ardexamericas.com/#sle.
2. Bostik Inc; www.bostik-us.com/#sle.
3. H.B. Fuller Construction Products, Inc; www.tecspecialty.com/#sle.
4. LATICRETE International, Inc; www.laticrete.com/#sle.
5. Mapei Corporation; www.mapei.com/#sle.
6. Schluter-Systems; www.schluter.com/#sle.

C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

1. Products:
   a. H.B. Fuller Construction Products, Inc; TEC TotalFlex 110 Universal Mortar: www.tecspecialty.com/#sle.
   b. LATICRETE International, Inc; TRI-LITE: www.laticrete.com/#sle.
   c. Mapei Corporation; Adesilex P10 Mosaic & Glass Tile: www.mapei.com/#sle.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. Bostik Inc; www.bostik-us.com/#sle.
2. H.B. Fuller Construction Products, Inc; www.tecspecialty.com/#sle.
3. LATICRETE International, Inc; www.laticrete.com/#sle.
4. Mapei Corporation; www.mapei.com/#sle.

C. Standard Grout: ANSI A118.6 standard cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
3. Color(s): As selected by Architect from manufacturer's full line.

2.05 Maintenance Materials

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.

1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.

1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
2. Fluid or Trowel Applied Type:
   a. Material: Synthetic rubber or Acrylic.
   b. Thickness: 20 mils (0.5 mm), maximum.
   c. Products:
      1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
      2) LATICRETE International, Inc; LATICRETE FRACTURE BAN SC: www.laticrete.com/#sle.
      3) Mapei Corporation; Mapelastic CI: www.mapei.com/#sle.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
   a. Material: Synthetic rubber or Acrylic.
   b. Thickness: 25 mils (0.6 mm), minimum, dry film thickness.
   c. Products:
      1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
      2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
      3) Mapei Corporation; Mapelastic AquaDefense: www.mapei.com/#sle.

C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch (11 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles square.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - FLOORS - FLOATING

A. Install in accordance with manufacturer's instructions.

B. Grout with standard grout as specified above.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary insulation above ceiling.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6 by 6 inch (152 by 152 mm) in size illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.04 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Armstrong World Industries, Inc; www.armstrongceilings.com/#sle.
2. Certainteed Architectural; www.certainteed.com/ceilings-and-walls/#sle.
3. Kinetics Noise Control, Inc; www.kineticsnoise.com/#sle.
4. USG Corporation; www.usg.com/ceilings/#sle.

B. Suspension Systems:

1. Armstrong World Industries, Inc; www.armstrongceilings.com/#sle.
2. Certainteed Architectural; www.certainteed.com/ceilings-and-walls/#sle.
3. Kinetics Noise Control, Inc; www.kineticsnoise.com/#sle.
4. USG Corporation; www.usg.com/ceilings/#sle.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels (ACT-1), Glass fiber with membrane-faced overlay, attached to suspended ceiling grid with baffle clips, with the following characteristics:

1. Classification: ASTM E1264 Type XII.
   a. Form: 1, plastic.
   b. Pattern: "E" - lightly textured.
2. Size: 24 by 24 inches (610 by 610 mm).
3. Thickness: 1 inch (25 mm).
4. Light Reflectance: Not less than 0.88 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.70 to 0.90, determined in accordance with ASTM E1264.
6. Articulation Class (AC): Not less than 190, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): Not less than 26, determined in accordance with ASTM E1264.
8. Panel Edge: Flush reveal.
9. Color: White.
10. Suspension System: Exposed.

B. Acoustical Panels (ACT-2), Mineral fiber with membrane-faced overlay, attached to suspended ceiling grid with baffle clips, with the following characteristics:

1. Classification: ASTM E1264 Type XII.
   a. Form: 1, plastic.
   b. Pattern: "E" - smooth textured.
2. Size: 24 by 24 inches (610 by 610 mm).
3. Thickness: 5/8 inch (16 mm).
4. Light Reflectance: Not less than 0.80 percent, determined in accordance with ASTM E1264.

5. NRC Range: Not applicable.
6. Articulation Class (AC): Not applicable.
7. Ceiling Attenuation Class (CAC): Not less than 35, determined in accordance with ASTM E1264.
8. Panel Edge: Flush.
9. Color: White.
10. Suspension System: Exposed.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Exposed Suspension System, Type ACT-1: Hot-dip galvanized steel grid and cap.

1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch (24 mm) face width.
3. Finish: As indicated on Drawings.
4. Color: As indicated on drawings.
5. Products:
   a. Armstrong World Industries, Inc.; 15/16" Prelude: www.armstrongce.
   b. Certainteed Architectural; 15/16" EZ Stab Classic System: www.certainteed.com/ceilings-and-walls/#sle.
   c. USG Corporation; Donn Brand Centricitee DXT/DXLT 15/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.

C. Exposed Suspension System, Type ACT-2: Aluminum.

1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch (24 mm) face width.
3. Finish: As indicated on Drawings.
4. Color: As indicated on drawings.
5. Products:
   a. Armstrong World Industries, Inc.; 15/16" Clean Room: www.armstrongce.
   b. Certainteed Architectural; 15/16" EZ Stab All-Aluminum Cleanroom System: www.certainteed.com/ceilings-and-walls/#sle.
   c. USG Corporation; Donn Brand Centricitee AX/AXCE 15/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.

1. Size: As required for installation conditions.
2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

D. Acoustical Insulation: Specified in Section 072100.

1. Thickness: 2 inch (51 mm).

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 Preparation

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.

D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

F. Lay acoustical insulation in areas as indicated on reflected ceiling plans.

3.05 CLEANING

A. Clean surfaces.

B. Replace damaged or abraded components.

END OF SECTION

SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Resilient stair accessories.

C. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

B. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006 (Reapproved 2018).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

G. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).

H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, 12 by 12 inch (305 by 305 mm) in size illustrating color and pattern for each resilient flooring product specified.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Installer's Qualification Statement.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: 25 square feet (2.3 square meters) of each type and color.
3. Extra Wall Base: 150 linear feet (45 linear meters) of each type and color.
4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

C. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 STAIR COVERING

A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Angle Fit Rubber Stair Treads: www.johnsonite.com/#sle.
   b. Mannington Commercial; Colorscape Stair Treads: www.manningtoncommercial.com#sle.
   c. Roppe Corporation; Rubber Stair Treads: www.roppe.com/#sle.

2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
3. Nominal Thickness: 0.1875 inch (4.75 mm).

4. Nosing: Square.
5. Texture: Smooth.
6. Color: To be selected by Architect from manufacturer's full range.

B. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Angle Fit Rubber Stiar Risers: www.johnsonite.com/#sle.
   b. Mannington Commercial; Colorscape Stiar Risers: www.manningtoncommercial.com#sle.
   c. Roppe Corporation; Rubber Stair Risers: www.roppe.com/#sle.

2. Thickness: 0.080 inch (2.0 mm).

2.02 RESILIENT BASE

A. Resilient Base - Type WB1: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Straight Base: www.johnsonite.com/#sle (basis-of-Design).
   b. Mannington Commercial; Burkebase TP: www.manningtoncommercial.com#sle.
   c. Roppe Corporation; Pinnacle Wall Base: www.roppe.com/#sle.
2. Height: 4 inches (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Profile: Straight / No Toe
5. Finish: Satin.
6. Length: Roll.
7. Color: As indicated on drawings.
8. Accessories: Premolded external corners and internal corners.

B. Resilient Base - Type WB2: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Straight Base: www.johnsonite.com/#sle (basis-of-Design).
   b. Mannington Commercial; Burkebase: www.manningtoncommercial.com#sle.
   c. Roppe Corporation; Pinnacle Wall Base: www.roppe.com/#sle.
2. Height: 4 inches (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Profile: Straight / No Toe
5. Finish: Satin.
6. Length: Roll.
7. Color: As indicated on drawings.

8. Accessories: Premolded external corners and internal corners.

C. Resilient Base - Type WB3: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Cove Base: www.johnsonite.com/#sle (basis-of-Design).
   b. Mannington Commercial; Burkebase TP: www.manningtoncommercial.com#sle.
   c. Roppe Corporation; Pinnacle Wall Base: www.roppe.com/#sle.
2. Height: 4 inches (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Profile: Cove
5. Finish: Satin.
6. Length: Roll.
7. Color: As indicated on drawings.
8. Accessories: Premolded external corners and internal corners.

D. Resilient Base - Type WB4: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Straight Base: www.johnsonite.com/#sle (basis-of-Design).
   b. Mannington Commercial; Burkebase TP: www.manningtoncommercial.com#sle.
   c. Roppe Corporation; Pinnacle Wall Base: www.roppe.com/#sle.
2. Height: 4 inches (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Profile: Straight / No Toe
5. Finish: Satin.
6. Length: Roll.
7. Color: As indicated on drawings.
8. Accessories: Premolded external corners and internal corners.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

C. Clean substrate.

3.03 Installation - General

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

D. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 Installation - Resilient Base

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.05 Installation - Stair Coverings

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096700 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, and patterns and colors available.

C. Samples: Submit two samples, 12 by 12 inch (305 by 305 mm) in size illustrating color and pattern for each floor material for each color specified.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

F. Manufacturer's Qualification Statement.

G. Applicator's Qualification Statement.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Top Coat Materials: Quantity sufficient to provide 800 sf coverage at system thickness specified in this section.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section.

1. Minimum 3 years of documented experience.
2. Approved by manufacturer.

B. Supervisor Qualifications: Trained by product manufacturer .

C. Manufacturer Field Technical Service Representative: Fluid-applied flooring manufacturer shall provide field technical service representative to assist in the quality assurance and quality control process of the installation and be available to perform field problem solving issues with the installer.

1.05 MOCK-UPS

A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.

1. Number of Mock-Ups to be Prepared: One.
2. Use same materials and methods for use in the work.
3. Use approved design samples as basis for mock-ups.
4. Locate where directed.
5. Minimum Size: 48 inches by 48 inches (1220 mm by 1220 mm).

B. Obtain approval of mock-up by Architect before proceeding with work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.07 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).

B. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 Fluid-Applied Flooring SYSTEMS

A. Fluid-Applied Flooring Type RF-1 and RF-2: Epoxy base coat(s), with troweled aggregate.

1. Aggregate: Quartz granules.
2. Top Coat: Polyurethane.
3. System Thickness: 1/8 inch (3.2 mm), nominal, dry film thickness (DFT).
4. Texture: Smooth.

5. Sheen: High gloss.
6. Color: As indicated on Drawings.
7. Products:
   a. Stonhard; Stontec TRF: www.stonhard.com/#sle (Basis-of-Design).
   b. Sherwin-Williams Company; Armorseal Armorquartz 100% Solids Epoxy: www.protective.sherwin-williams.com/#sle.
   c. Sika Corporation; Sikafloor Quartzite Broadcast System: www.sikafloorusa.com/#sle.
   d. TNEMEC; 1/8" Deco-Tread Quartz System: www.tnemec.com/#sle.

2.02 ACCESSORIES

A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

B. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).

   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

D. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

D. Cove at vertical surfaces.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION

SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpeting, Type CF-1 / CF-2: Multi-level pattern loop, manufactured in one color dye lot.

1. Product: Texture Study manufactured by Shaw Contract.
2. Tile Size: As indicated on Drawings.
3. Thickness: 0.285 inch (7.2 mm).
4. Color: As indicated on Drawings.
5. Pattern: As indicated on Drawings.
6. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
7. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
8. Gauge: 1/10 inch (39.4 per 10 cm).
9. Stitches: 9.0 per inch (35.0 per cm).
10. Pile Thickness: 0.137 inch (3.48 mm).
11. Primary Backing Material: Synthetic.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, clear anodized color.

C. Adhesives:

1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 097200 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and prime painting.

B. Wall covering and borders.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Samples: Submit two samples of wall covering, 8 by 10 inch (203 by 254 mm) in size illustrating color, finish, and texture.

D. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

G. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 Wall Coverings

A. General Requirements:

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

B. Wall Covering: Fabric-backed vinyl roll stock.

1. Total Thickness: 6 mil.
2. Backing: Non-woven, synthetic fabric.
3. Color: As indicated on Drawings.
4. Pattern: As indicated on Drawings.
5. Manufacturers:
   a. (Basis-of-Design) Koroseal/RJF International; Reatec: www.koroseal.com.
   b. DesignTex; DI-NOC: www/designtex.com.
   c. MDC Interior Solutions; MDC Type II Wallcoverings: www.mdcwall.com/#sle.

C. Adhesive: Contact type.

D. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

E. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

F. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

D. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

E. Butt edges tightly.

F. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

G. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

H. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 098430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 Section Includes

A. Sound-absorbing panels.

1.02 Related Requirements

A. Section 099123 - Interior Painting.

1.03 Reference Standards

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.04 Submittals

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

1.05 Quality Assurance

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least five years of documented experience.

B. Installer Qualifications: Company specializing in the installation of products of the type specified in this section, with at least five years of documented experience, including references to projects completed.

1.06 Delivery, Storage, and Handling

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 PET Felt Sound-Absorbing Units

A. Wall & Ceiling Baffles: PET Felt.

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. PET felt panelized product featuring protruding felt blades bonded to felt backing panel.
3. Sound Absorption: Noise Reduction Coefficient (NRC) or Sound Absorption Average (SAA) of 0.80 when tested in accordance with ASTM C423.
4. Shape: Rectangular blades.
5. Panel Size: 24 inch by 24 inch (610 mm by 610 mm).
   a. Blade size: 1.3 inch width by 1" depth.
   b. Blade spacing: 3.4 inches on center.
   c. Number of blades per panel: 7.
6. Mounting: Back mounted to gypsum board substrate with mechanical fasteners. Panels are to extend across the top of horizontal cap on top of offices and conference room and turn vertically down face of wall.
7. Color: As indicated on Drawings.
8. Products:
   a. Turf Design, Inc; Grille: www.turf.design.
   b. MDC Interior Solutions; Zintra Sticks: www.mdcwall.com.
   c. Momentum Textiles & Wallcovering; Bengal Solid Color: www.momentumtextilesandwalls.com.

2.02 Accessories

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:

1. Z-clip hanger system with 2” clips factory-mounted to back of panel and field-mounted to wall surface.

PART 3 EXECUTION

3.01 Installation

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:

1. Plumb and level.
2. Flatness.

3.02 Cleaning

A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.03 Protection

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Wood window frames, sashes, trim, and perimeter sealant.
2. Wood soffits and rafter tails
3. Exterior wall panels at upper monitor.
4. Louvers and frames.
5. All items indicated to be painted on Drawings.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Floors, unless specifically indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

B. Paints:

1. Behr Paint Company; www.behr.com/#sle.
2. Pittsburgh Paints; www.ppgpaints.com/#sle.
3. Sherwin-Williams Companywww.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including Previously painted wood.

1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
   a. Products:
      1) Behr Premium Plus Exterior Satin Enamel [No.9050]. (MPI #15)
      2) Pittsburgh Paints Sun Proof Exterior Latex, 76-110XI Series, Satin. (MPI #15)
      3) Sherwin-Williams SuperPaint Exterior.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Latex Primer for Exterior Wood; MPI #6.
   a. Products:
      1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No.436]. (MPI #6)
      2) Pittsburgh Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #6)
      3) Sherwin-Williams Exterior Latex Primer, B42W8041. (MPI #6)

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Mechanical and Electrical:
    a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    b. In finished areas, paint shop-primed items.
    c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Marble, granite, slate, and other natural stones.
6. Floors, unless specifically indicated.
7. Ceramic and other tiles.
8. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
9. Glass.
10. Acoustical materials, unless specifically indicated.
11. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
2. MPI product number (e.g., MPI #47).
3. Cross-reference to specified paint system products to be used in project; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 5 gal (19 L) of each color; from the same product run, store where directed. Provide in 1 gallon containers.
3. Label each container with color in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Behr Paint Company: www.behr.com/#sle.
2. PPG Paints: www.ppgpaints.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   b. USGBC LEED Rating System for interior wall and ceiling finishes (all coats), anti-corrosive paints on interior ferrous metal, sanding sealers, other sealers, and floor coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.

1. Two top coats and one coat primer.
2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
   a. Products:
      1) Behr Premium Plus Interior Satin Enamel [No.7050]. (MPI #146)
      2) PPG Paints Speedhide Max Interior Latex, 6-9610 Series, Lo Lustre. (MPI #146)
      3) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #144)
3. Top Coat Sheen:
   a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
   b. Velvet: MPI gloss level 2; use this sheen at all locations, unless otherwise indicated.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:

1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
2. Two top coats and one coat primer.
3. Top Coat(s): Interior Alkyd, Water Based; MPI #157, 167, 168, or 169.
   a. Products:
      1) Dunn-Edwards Corporation; Aristoshield Interior/Exterior Semi-Gloss Paint. (MPI #169)
      2) PPG Paints Speedhide Interior/Exterior WB Alkyd, 6-1510XI Series, Semi-Gloss.
      3) Sherwin-Williams ProMar 200 Waterbased Acrylic-Alkyd, Semi-Gloss.

4. Top Coat Sheen:
   a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
5. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, galvanized piping, and overhead hangers and struts.

1. Shop primer by others.
2. One top coat.
3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
   a. Products:
      1) Behr Pro HPC Waterborne Acrylic Dryfall Flat, Black [No.HP210]. (MPI #118)
      2) Dunn-Edwards Corporation; Aquafall Interior Flat Dry Fall Paint. (MPI #118)
      3) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)

D. Paint I-TR-C - Transparent Finish on Concrete Floors.

1. 1 coat stain.
2. Sealer: Water Based Sealer for Concrete Floors; MPI #99.
   a. Products:
      1) Behr Premium Wet-Look Sealer Low-Lustre [No.986]. (MPI #99)
      2) PPG Paints Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer, 4-6200XI, Satin. (MPI #99)
      3) Sherwin-Williams H&C Clarishield Water-Based Wet-Look Concrete Sealer. (MPI #99)

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
   a. Products:
      1) PPG Paints Speedhide zero VOC Interior Latex Sealer, 6-4900XI. (MPI #149)
      2) Rodda Roseal II, 502701. (MPI #149)
      3) Vista Paint Corporation; 5001 V-PRO 5000 Primer: www.vistapaint.com/#sle. (MPI #149)

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 Section Includes

1.01.A. Dimensional letter signage.

1.02 Submittals

1.02.A. See Section 013000 - Administrative Requirements for submittal procedures.

1.02.B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

1.02.C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

1.02.D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

1.02.E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.03 Quality Assurance

1.03.A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.04 Delivery, Storage, and Handling

1.04.A. Package dimensional letter signs as required to prevent damage before installation.

1.04.B. Store under cover and elevated above grade.

1.05 Warranty

1.05.A. Provide manufacturer's warranty from Date of Substantial Completion against defects in materials and workmanship for a minimum of five (5) years.

PART 2 PRODUCTS

2.01 Manufacturers

2.01.A. Dimensional Letter Signs:

1. A.R.K. Ramos: www.arkramos.com/#sle.
2. CityScapes Inc: www.cityscapesinc.com/#sle.
3. Takeform: www.takeform.net/#sle.

2.02 Dimensional Letters

2.02.A. Applications: Building identification.
1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.

2.02.B. Metal Letters:
1. Material: Aluminum casting.
2. Thickness: 3/4 inch minimum (19 mm).
3. Letter Height: 8 inches (203 mm) for building name; 6 inches (152 mm) for building address.
4. Text and Typeface:
   a. Character Font: Kabel.
   b. Character Case: Upper case only.
5. Finish: Brushed, satin with clear protective coating.
6. Mounting: Projected mount using studs with 1/4 inch spacers.

PART 3 EXECUTION

3.01 Examination

3.01.A. Verify that substrate surfaces are ready to receive work.

3.01.B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 Installation

3.02.A. Install in accordance with manufacturer's instructions.

3.02.B. Install with horizontal edges level.

3.02.C. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 101423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 Section Includes

1.01.A. Panel signage.

1.02 Reference Standards

1.02.A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

1.02.B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 Submittals

1.03.A. See Section 013300 - Submittal Requirements for submittal procedures.

1.03.B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

1.03.C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    c. Submit for approval by Owner through Architect prior to fabrication.

1.03.D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

1.03.E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.03.F. Manufacturer's qualification statement.

1.03.G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.04 Quality Assurance

1.04.A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 Delivery, Storage, and Handling

1.05.A. Package signs as required to prevent damage before installation.

1.05.B. Package room and door signs in sequential order of installation, labeled by floor or building.

1.05.C. Store tape adhesive at normal room temperature.

1.06 Field Conditions

1.06.A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

1.06.B. Maintain minimum ambient temperature during and after installation.

1.07 Warranty

1.07.A. Provide manufacturer's warranty from Date of Substantial Completion against defects in materials and workmanship for a minimum of five (5) years.

PART 2 PRODUCTS

2.01 Manufacturers

2.01.A. Panel Signage:
1. Takeform (Basis-of-Design); Vivid: www.takeform.net.
2. Best Sign Systems, Inc; Impressions: www.bestsigns.com.
3. Mohawk Sign Systems, Inc; 1000 ADA System: www.mohawksign.com.

2.02 Regulatory Requirements

2.02.A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.03 Panel Signage

2.03.A. Panel Signage Type 1 & Type 2:
1. Application: Room signs.
2. Description: Flat signs with direct-printed acrylic panel and tactile characters.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 3/8 inch (9 mm).
5. Sign Edges: Squared.

6. Letter Edges: Squared.
7. Corners: Radiused.
8. Color and Font, unless otherwise indicated:
    a. Character Font: Helvetica medium font.
    b. Character Case: Upper case.
    c. Background Color: As scheduled.
    d. Character Color: Contrasting color.
9. Material: Two-layer acrylic panel with letters and graphics direct printed onto #2 surface of panel.
    a. Insert components to be 0.080 inch non-glare acrylic window, inlaid flush to sign face.
10. Profile: Flat panel.
11. Tactile Letters: Raised 1/32 inch minimum.
12. Braille: Grade II, ADA-compliant.
13. One-Sided Wall Mounting: Tape adhesive.

2.03.B. Panel Signage Type 3:

1. Application: Room signs without insert.
2. Description: Flat signs with direct-printed acrylic panel and tactile characters.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 3/8 inch (9 mm).
5. Sign Edges: Squared.
6. Letter Edges: Squared.
7. Corners: Radiused.
8. Color and Font, unless otherwise indicated:
    a. Character Font: Helvetica medium font.
    b. Character Case: Upper case.
    c. Background Color: As scheduled.
    d. Character Color: Contrasting color.
9. Material: Two-layer acrylic panel with letters and graphics direct printed onto #2 surface of panel.
10. Profile: Flat panel.
11. Tactile Letters: Raised 1/32 inch minimum.
12. Braille: Grade II, ADA-compliant.
13. One-Sided Wall Mounting: Tape adhesive.

2.03.C. Panel Signage Type 4:

1. Application: Restroom signs.
2. Description: Flat signs with direct-printed acrylic panel and tactile characters.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 3/8 inch (9 mm).
5. Sign Edges: Squared.
6. Letter Edges: Squared.
7. Corners: Radiused.
8. Color and Font, unless otherwise indicated:
    a. Character Font: Helvetica medium font.
    b. Character Case: Upper case.

c. Background Color: As scheduled.
d. Character Color: Contrasting color.
e. Pictogram: Provide “dynamic” or “active” International Symbol of Accessibility with tactile strokes and contrasting color to match requirements of Character messaging.

9. Material: Two-layer acrylic panel with letters and graphics direct printed onto #2 surface of panel.
10. Profile: Flat panel.
11. Tactile Letters: Raised 1/32 inch minimum.
12. Braille: Grade II, ADA-compliant.
13. One-Sided Wall Mounting: Tape adhesive.

2.03.D. Panel Signage Type 5 & Type 6:

1. Application: Safety equipment signs.
2. Description: Flat signs with direct-printed acrylic panel.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 3/8 inch (9 mm).
5. Sign Edges: Squared.
6. Letter Edges: Squared.
7. Corners: Radiused.
8. Color and Font, unless otherwise indicated:
   a. Character Font: Helvetica medium font.
   b. Character Case: Upper case.
   c. Background Color: White.
   d. Character Color: Green color; match “Osha Green” be Basis-of-Design manufacturer.
9. Material: Two-layer acrylic panel with letters and graphics direct printed onto #2 surface of panel.
10. Profile: Flat panel.
11. One-Sided Wall Mounting: Tape adhesive.

2.03.E. Panel Signage Type 7:

1. Application: Room signs with owner-provided insert.
2. Description: Flat signs with direct-printed acrylic panel and tactile characters.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 3/8 inch (9 mm).
5. Sign Edges: Squared.
6. Letter Edges: Squared.
7. Corners: Radiused.
8. Color and Font, unless otherwise indicated: Not Applicable
   a. Character Font: Helvetica medium font.
   b. Character Case: Upper case.
   c. Background Color: As scheduled.
   d. Character Color: Contrasting color.
9. Material: Two-layer acrylic panel with 0.125 inch non-glare acrylic window, inlaid flush to sign face.
10. Profile: Flat panel.

11. Tactile Letters: Raised 1/32 inch minimum.
12. Braille: Grade II, ADA-compliant.
13. One-Sided Wall Mounting: Tape adhesive.

2.04 SIGNAGE APPLICATIONS

2.04.A. Room and Door Signs:

1. Office Doors: Identify with room names and numbers indicated on drawings; provide "window" section for replaceable occupant name.
2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
3. Service Rooms: Identify with room names and numbers indicated on drawings.
4. Rest Rooms: Identify with pictograms, the name "RESTROOM", and braille.

2.05 Accessories

2.05.A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 Examination

3.01.A. Verify that substrate surfaces are ready to receive work.

3.01.B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 Installation

3.02.A. Install in accordance with manufacturer's instructions.

3.02.B. Install with horizontal edges level.

3.02.C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

3.02.D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 102123 - CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface mounted overhead curtain track and guides.

B. Blackout curtains.

1.02 RELATED REQUIREMENTS

A. Section 095100 - Acoustical Ceilings: Suspended ceiling system to support track.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.

D. Samples: Submit 12 by 12 inch (300 by 300 mm) sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement and carrier attachment to curtain header.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Carriers: Twenty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cubicle Track and Curtains:

1. Blackout Curtains; www.blackoutcurtains.com.
2. Construction Specialties, Inc; www.c-sgroup.com.
3. Inpro; www.inprocorp.com.
4. ThorLabs; www.thorlabs.com.

2.02 TRACKS AND TRACK COMPONENTS

A. Tracks: Extruded aluminum sections; one piece per track run.

1. Profile: Channel.
2. Mounting: Surface.
3. Structural Performance: Capable of supporting vertical test load of 50 lbs (23 kg) without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
4. Track End Stop: To fit track section.
5. Finish on Exposed Surfaces: Black enamel.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.

1. Provide 2 carriers per foot of track length (6 carriers per meter of track length)

C. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.03 CURTAINS

A. Cubicle Curtains:

1. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.

B. Blackout Curtains:

1. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
2. Material: Polyester.
3. Color: Black.
4. Valance: Same material and color as blackout curtain, adhered to face of track with hook and loop fastener strip, 6 inch (152 mm) drop.

C. Curtain Fabrication:

1. Width of curtain to be 10 percent wider than track length.
2. Length of curtain to end 10 inches (254 mm) above finished floor.
3. Pattern match fabric with vertical seams.
4. Curtain Heading: Fabric band matching curtain panel with metal grommet holes for carriers spaced 6 inches (150 mm) on center.
5. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. Secure track to ceiling system.

C. Install end cap and stop device.

D. Install curtains on carriers ensuring smooth operation.

E. Install blackout curtain valance on face of track.

END OF SECTION

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 SUBMITTALS

A. See Section 013300 - Submittal Procedures for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards, 24 inches (610 mm) long.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:

1. Babcock-Davis; Stainless Steel Corner Guards: www.babcockdavis.com/#sle.
2. Construction Specialties, Inc; CO Series: www.c-sgroup.com/#sle.
3. Inpro; Stainless Steel Corner Guards: www.inprocorp.com/#sle.

2.02 PRODUCT TYPES

A. Corner Guards - Surface Mounted:

1. Material: Type 304 stainless steel, No. 4 finish, 16 gauge thick.
2. Width of Wings: 3-1/2 inches (76 mm).
3. Corner: Square.
4. Length: One piece.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that substrate surfaces for adhered items are clean and smooth.

C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches (102 mm) above finished floor to 48 inches high (1219 mm high).

3.03 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

1. Where indicated, restroom products are owner-furnished, contractor-installed (OFCI). If OFCI is not indicated, contractor is to furnish and install specified products.

B. Utility room accessories.

1.02 SUBMITTALS

A. See Section 013300 - Submittal Procedures, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 The Contractor must purchase restroom accessories through Cornell Building Care. Approved products for each type of accessory are specified within this section.

2.02 Commercial Toilet Accessories

A. Toilet Paper Dispenser: Double roll, surface mounted, for coreless type rolls.

1. Products:
   a. (OFCI) Georgia Pacific Compact Coreless Tissue Fixture 56746A.

B. Paper Towel Dispenser (OFCI): Manual, roll paper type.

1. Cover: Opaque Black.
2. Paper Discharge: Manual operation by push paddle operation.
3. Capacity: 8-inch diameter roll.
4. Mounting: Surface mounted.
5. Refill Indicator: Transparent viewing slot.
6. Products:
   a. Georgia-Pacific; GP Pro Universal Push-Paddle Paper Towel Dispenser 54338A

C. Waste Receptacle (OFCI): Slim Jim RMD 3540, freestanding style.

D. Hand Soap Dispenser (OFCI): Deb Soap Proline Curved White, with Cornell University logo, 1-liter unit (SBS 91128), wall mounted

E. Grab Bars: Stainless steel, smooth surface.

1. Standard Duty Grab Bars:
   a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
   b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
   c. Finish: Satin.
   d. Length and Configuration: As indicated on drawings.
   e. Products:
      1) AJW Architectural Products; UG2-A Series: www.ajw.com/#sle.
      2) American Specialties, Inc; 3700 Series: www.americanspecialties.com/#sle.
      3) PROFLO; PFGB12SF4 - PROFLO 12 inch Stainless Steel Grab Bar in Satin: www.ferguson.com/#sle.
      4) Standard Metal Hardware Manufacturing, Ltd; Grab Bars: www.smhardware.com/#sle.

F. Sanitary Napkin/Tampon Dispenser: Bobrick Trimline Series B370639, surface-mounted.

G. Sanitary Napkin Disposal Unit: Impact Products 25125200, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

2.03 Utility Room Accessories

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.

1. Hooks: Two, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
3. Length: 36 inches (900 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

1. Grab Bars: As indicated on drawings.
2. Other Accessories: As indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 104300 - EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Automated external defibrillator (AED) cabinets.

C. Accessories.

1.02 DEFINITIONS

A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.03 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include test schedules and recertification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Automated External Defibrillators (AEDs):

1. Philips Medical Systems; Heartstart OnSite: www.usa.philips.com/#sle.
2. Stryker Corporation; LIFEPAK CR2 Defibrillator - LP-CR2: www.stryker.com/#sle.
3. ZOLL Medical Corporation; AED Plus: www.zoll.com/#sle.

2.02 EMERGENCY AID CABINETS

A. Type: Automated external defibrillator (AED).

B. Cabinet Construction: Non-fire-rated.

1. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

C. Cabinet Configuration: Recessed type.

1. Exterior nominal dimensions of 16-1/4 inch (410 mm) wide by 24-1/2 inch (620 mm) high by 2-1/2 inch (90 mm) deep.
2. Projected Trim: Returned to wall surface, with 2-1/2 inch (64 mm) projection, and 1 inch (25 mm) wide face.

D. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

E. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

G. Fabrication: Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: Powder coat, white color.

I. Finish of Door Pull or Handle: Stainless steel.

J. Finish of Cabinet Interior: White powder coat.

2.03 ACCESSORIES

A. Alarm Contacts: Contact devices.

B. Cabinet Door Signage: 'AED" decal, or vinyl self-adhering, prespaced black lettering and identifying graphic in accordance with authorities having jurisdiction (AHJ).

C. Plastic Wall Signage: Right Angle style.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 48 inches (122 mm) from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place AEDs in cabinets.

E. Wall Signs:

1. Location: Where shown.

F. Cabinet Lettering:

1. Location: Face of door framing.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate smoothly without binding. Verify that alarms and integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes. Replace cabinets that cannot be restored to factory-finished appearance. Use materials and procedures recommended by cabinet manufacturer.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of AED to Owner's designated representative.

END OF SECTION

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, and color and finish.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, locations of individual fire extinguishers, and mounting measurements for wall bracket.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Amerex Company; ABC Dry Chem: www.amerex-fire.com.
2. Badger Fire; B10M: www.badgerfire.com
3. Potter-Roemer; Model 3010: www.potterroemer.com.

B. Fire Extinguisher Cabinets and Accessories:

1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com.

2. Kidde, a unit of United Technologies Corp; Model 468004: www.kidde.com.
3. Potter-Roemer; Model 7008: www.potterroemer.com.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

1. Class: A:B:C type.
2. Size: 10 pound (4.54 kg).
3. Finish: Baked polyester powder coat, Red color.
4. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

1. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Semi-recessed type.

1. Exterior nominal dimensions of 12-1/2 inch (318 mm) wide by 27-1/2 inch (699 mm) high by 7-1/2 inch (191 mm) deep.
2. Projected Trim: Returned to wall surface, with 1-1/2 inch (38 mm) projection, and 2-1/4 inch (57 mm) wide face.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Red baked enamel.

H. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 22 inches (559 mm) from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 115300 – MISCELLANEOUS FIXED LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Furnish all labor, materials, tools, equipment, and services for all equipment as indicated in accord with provisions of Contract Documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically shown or specified, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation. Installation shall include all required assembly.

D. Equipment in this section

Sect	Identification	Equipment Description
2.1	ICE	Ice Machine
2.2	ST	Steam Sterilizer (with Electric Clean Steam Generator)
2.3	UCW	Undercounter Glassware Washer

1.3 RELATED WORK:

A. Relevant trade contractors shall provide rough openings, pits, substrate preparation and blocking for all equipment installations.

B. Mechanical contractor shall provide exhaust rough-ins and final connections for all equipment installations.

C. Plumbing contractor shall provide supply/return service line, drain and vent rough-ins and final connections for all equipment installations.

D. Electrical contractor shall provide electrical service rough-ins and final connections for all equipment installations.

E. Telecommunication/Data contractor shall provide all tele/data service rough-ins, receptacles/terminals and final connections for all equipment installations.

F. Related Sections include the following:

1. Division 12 Section “Laboratory Casework”

2. Division 23 and 26 Sections for installing service fittings specified in this section.

3. Divisions 23 and 26 for connecting service utilities at indicated points. Piping and wiring for service fittings up to point of connection are specified in this Section.

4. Construction Waste Management - Section 01 7419

5. Sustainable Design Requirements – Section 01 8113

6. Indoor Air Quality Requirements - Section 01 01 8114

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualification: Minimum five (5) years' experience producing products similar to those required for this Project. Documented experience of successfully providing products for three (3) projects of scope, schedule, and complexity similar to this Project within the last two (2) years.

1. Manufacturer shall be a firm having an established organization and factory, with production facilities specializing in the type of equipment specified, having an experienced engineering department and an established history of similar installations of equal scope and complexity.

2. Company marketing primary products specified for this Section shall also be manufacturer. Companies marketing products which are manufactured by third parties for private labeling by marketing company shall not be allowed.

3. Submit qualifications on manufacturers' letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

4. Each piece of equipment listed includes the manufacturer's name, establishing levels of quality, specific construction features, operating conditions and desired features and accessories. By indicating other manufacturer's names does not relieve perspective bidders of their obligation to prove that their submissions are equal to specified equipment in size, construction, performance, basic features, options and accessories prior to award.

5. Service response time, as described herein, shall be considered eligible to bid. Service response time to a telephone inquiry shall be same day followed up by a factory trained technician at site within 24 hours of telephone inquiry; all serviceable components warehoused or readily available to service personnel; and fast access to shop drawings of all equipment in field. Any misrepresentations or negative references shall be considered grounds for bid rejection.

B. Installer's Qualifications: An authorized representative of the manufacturer for installation and maintenance of units required for this Project. Minimum five (5) years' experience installing products similar to those required for this Project. Documented experience of successfully completing three (3) projects of scope, schedule, and complexity similar to this Project within last two (2) years.

1. Submit Qualifications on Installer's letterhead. Include project descriptions with Owner and Design Professional contacts for previous experience.

2. An authorized representative of the manufacturer for installation and maintenance of units required for this Project.

C. Equipment may be inspected by Owner at manufacturer's plant prior to shipment. Equipment found not in accord with specifications and approved drawings may be rejected. Replace rejected equipment at no cost to Owner. Provide Owner's Representative two (2) week prior notice to all factory testing.

D. Electric operated and/or heated equipment shall comply with applicable standards of National Electrical Manufacturer's Association (NEMA), National Electric Code (NEC) and Underwriters' Laboratories, Inc. (UL) or Electrical Testing Lab (ETL).

E. Testing Agency Qualifications: An independent agency qualified for testing indicated, as documented according to ASTM E 548.

F. SINGLE SOURCE REQUIREMENTS: Primary products required for Work of this Section shall be supplied by one (1) manufacturer. Accessory products including, for example, fasteners, sealants and anchors may be from other than primary manufacturer if approved by primary manufacturer.

G. REGULATORY REQUIREMENTS: Comply with the following in accordance with Division

1. UL, FM Global, NFPA 30 and local building code requirements.

1.5 EXCEPTIONS TO DRAWINGS AND SPECIFICATION

A. All exceptions shall be subject to written approval prior to receipt of bid. If no written communication is received prior to receipt of bid and approval indicated in an addendum, it is assumed that bidder shall be in total compliance with specifications and shall be held responsible for default or delay, regardless of any statement to the contrary in their written proposal.

1.6 SUBSTITUTIONS

A. Review this article with Owner to confirm what is considered a substitution by Owner and to coordinate Owner's role in approving substitutions. If substitution requests are restricted to before bid opening, include requirements in the Instructions to Bidders.

B. Requests for a substitution following the bid opening shall be rejected.

C. Substitutions approved prior to bid date shall be handled as an addendum and be sent to all bidders.

D. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Owner's Representative's shall consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect shall return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution is consistent with the Contract Documents and shall produce indicated results.

    b. Substitution request is fully documented and properly submitted.

    c. Requested substitution shall not adversely affect Contractor's construction schedule.

    d. Requested substitution has received necessary approvals of authorities having jurisdiction.

    e. Requested substitution is compatible with other portions of the Work.

    f. Requested substitution has been coordinated with other portions of the Work.

    g. Requested substitution provides specified warranty.

    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

E. Substitutions for Convenience: Not permitted unless otherwise noted.

1.7 SUBMITTALS

A. Specification Compliance. Submit copy of relevant item specification section (from this document) and clearly note in bold print any substitutions, modifications, or objections.

B. Product Data. Submit manufacturer's specifications and installation instructions for each item of laboratory equipment furnished. Indicate on product data which optional devices and operations are proposed for inclusion with equipment. Where substitutions for specified items of laboratory equipment are proposed, submit data substantiating the proposed equipment is equal to that specified. Manufacturer's specifications must contain a full, detailed explanation of all variations in operating and/or performance requirements.

C. Shop Drawings. In addition to work shown on manufacturer's printed product data, submit dimensional roughing-in drawing, showing equipment placed in actual project site conditions adjacent to other equipment and relationship to the work of other trades, as well as mechanical and electrical requirements. Rough-in drawings shall clearly indicate where equipment connection varies from relevant trade contractor supply source. Submit dimensioned fabrication drawings for custom fabricated equipment, including plans, elevations, and sections, at, showing materials and gauges used, include the following.

    1. Details of construction, kind and thicknesses of materials, hardware and accessories.

2. Blocking and other supports required for installation.

3. Conform to Coordination Drawings.

4. Plans: Minimum 1/4” = 1’-0” for all areas

5. Elevations: Minimum ¾” = 1’-0” for each exposed face of each bank or individual piece of equipment. "Ditto" or "opposite hand" faces shall not be acceptable.

6. Details: Minimum 1 1/2 inch = 1’-0” scale

D. Samples. Submit 12” x 12” samples of exposed finishes to the Architect and/or owner representative.

E. Operational and Maintenance Data. Submit operating and maintenance instructions and parts listing for each item of fixed laboratory equipment. Include this data, product data, shop drawings, wiring diagrams, and any other data required by Owner, in three-ring maintenance manual. Prepare draft copy of operation and maintenance manual for Owner's review. Submit four (4) copies of final, accepted manual for Owner's use.

F. Manufacturer's Qualifications. Letter confirming required minimum experience, references, and service response time.

G. Applicable standards approval from NEMA, NEC, UL, and ETL or as specified with the individual equipment items.

1.8 DELIVERY, STORAGE, HANDLING, AND INSTALLATION REQUIREMENTS

A. All equipment in this specification shall be Contractor Furnished/Contractor Installed (CFCI). Certain equipment items shall include Manufacturer Assembly (MA), Manufacturer’s Assembly Supervision (MAS), Manufacturer's Installation Supervision (MIS) or Manufacturer's Equipment Demonstration (MED). MIS includes MED.

B. Contractor Furnished/Contractor Installed (CFCI): General Contractor and/or relevant trade contractor (both identified as the "Contractor) to purchase, receive, unload, store, unpack, re-assemble, set-in-place, install and clean up equipment. Deliver to site in manufacturer's original labeled containers. Contractor to provide any fasteners supports or other miscellaneous items necessary for complete installation. All rough-ins and final connections by contractor. Contractor to use all means necessary to protect materials of this section before, during and after installation and to protect installed work and materials of all other trades. Contractor to confirm in writing that installed equipment meets or exceeds manufacturer's specifications. Contractor to provide owner's representative with rough-in and installation drawings of installed equipment. Where specified (MIS or MED), contractor shall coordinate with manufacturer installation supervision and/or on-site equipment demonstrations. Scheduling of on-site equipment demonstrations to be at the convenience of the Owner.

C. Owner Furnished/Owner Installed (OFOI): The owner shall purchase, deliver, receive, unload, store, unpack, assemble, set-in-place, install and clean up equipment.

D. Owner Furnished/Contractor Installed (OFCI): The owner shall purchase and deliver equipment to jobsite. Relevant trade contractor (the "contractor") shall receive, unload, store, unpack, assemble, set-in-place, install and clean up equipment. Deliver to jobsite in manufacturer's original labeled containers. Contractor to provide any fasteners, supports or other miscellaneous items necessary for complete installation. All rough-ins and final connections by contractor. Contractor shall use all means necessary to protect materials of this section before, during and after installation and to protect installed work and materials of all other trades. Contractor shall confirm in writing that installed equipment meets or exceeds manufacturer's specifications. Contractor shall provide owner's representative with rough-in and installation drawings of installed equipment.

E. Manufacturer Assembly (MA): Manufacturer shall provide adequate assembly personnel for as long as it takes to complete installation to satisfaction of owner's representative. Manufacturer's field supervision personnel may or may not be union depending on conditions of site. If schedule demands it, manufacturer shall agree to have their field assembly personnel work overtime at no additional cost. Manufacturer assembly and MED included in equipment price.

F. Manufacturer's Assembly Supervision (MAS): Manufacturer shall provide adequate assembly supervision personnel for as long as it takes to complete installation to satisfaction of owner's representative. Manufacturer's field supervision personnel may or may not be union depending on conditions of site. If schedule demands it, manufacturer shall agree to have their field supervision personnel work overtime at no additional cost. Manufacturer assembly supervision included in equipment price and provide following:

G. Manufacturer's Installation Supervision (MIS): Where noted in the specifications (i.e.: MIS), the manufacturer shall provide adequate installation supervision personnel for as long as it takes to complete the installation to the satisfaction of the owner's representative. Manufacturer's field supervision personnel may or may not be union depending on the conditions of the site. If the schedule demands it, manufacturer to agree to have their field supervision personnel work overtime at no additional cost. Manufacturer installation supervision shall be included in equipment price and provide the following:

1. Trip(s) to the job site to coordinate specific technical project requirements.

2. Trip(s) to the job site to instruct equipment installation crews.

3. Trip(s) to the job site to check final installation, trouble-shoot and start-up equipment.

4. One (1) one-day trip to the job site to instruct Owner on proper operation and maintenance of the equipment. Scheduling of on-site equipment demonstration to be at the convenience of the Owner.

H. Manufacturer's Equipment Demonstration (MED). Where noted in the specifications (i.e.: MED), the manufacturer shall provide one (1) one-day trip to the job site to instruct Owner on proper operation and maintenance of the equipment. Cost of this service shall be included in equipment price. Scheduling of on-site equipment demonstration to be at the convenience of the Owner.

1.9 WARRANTY

A. Except where more stringent warranty requirements are noted herein in individual equipment descriptions, all equipment furnished under this section guaranteed for a minimum of one (1) year unless otherwise noted, parts and labor, occupancy/acceptance by the client or specific equipment final acceptance (whichever is later) against defective materials, design and workmanship. Defects shall be promptly rectified at manufacturer or contractor's expense after notification by Owner's representative.

B. Submit warranty signed by Manufacturer and countersigned by Contractor, agreeing to replace / repair / restore defective equipment, components, materials and workmanship during the periods indicated for each item from date of Owner's acceptance. "Defective" is hereby defined to include (but not be limited to);

1. Operation or control system failures

2. Performance below required standards.

3. Excessive wear, unusual deterioration or aging of materials or finishes.

4. Excessive maintenance and similar unusual, unexpected and unsatisfactory conditions.

5. Ruptured, cracked, or stained coating.

6. Discoloration or lack of finish integrity.

7. Cracking or peeling of finish.

8. De-lamination of components.

9. Slippage, shift, or failure of attachment to wall, floor, or ceiling.

10. Weld or structural failure (visible weld marks).

11. Warping or unloaded deflection of components.

12. Failure of hardware.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment until building is enclosed, wet work is complete and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where equipment is indicated to fit to other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating field measurements. Coordinate

construction to ensure that actual dimensions correspond to established dimensions. Drawings show arrangement and location of items of equipment.

2. If it is necessary to vary from arrangement shown, because of structural, mechanical, electrical, or other considerations, make such variations only after approval of Architect and at no additional cost to the Owner.

C. Confirm that all equipment shall be able to be moved through building in order to reach it designated location. Provide dimensional information of equipment showing length, width and depth of equipment (or largest component) as it is intended to be moved through building. Dimensions should include all packaging, palleting. and transportation equipment dimensions so as to allow leave-out of overhead, walls, etc., to allow equipment to safely be transported to installation point. Failure to do so shall result in removals and re-installation's to be charged to manufacturer and/or contractor.

D. Where Compressed air is not an available service, or the available pressure is not adequate the manufacture of its respective equipment shall provide an integral air compressor on equipment requiring this service.

1.11 COORDINATION:

A. Coordinate installation of equipment with laboratory casework, mechanical, plumbing, and electrical work.

B. Coordinate layout of metal framing and reinforcements in wall assemblies for support of equipment specified herein.

1.12 PRE-CONSTRUCTION MEETINGS:

A. Approximately two (2) weeks before scheduled commencement of Work, meet at Project Site to coordinate installation.

B. Attendees: Installer, installer of each component of associated Work, installers of other Work that must precede or follow Work of this Section, Design Professional, Owner's Representative, manufacturer's representative, and other representatives concerned with Work, including (where applicable) Owner's insurers, and governing authorities.

C. Review foreseeable methods and procedures:

1. Tour areas of installation, observe and evaluate condition of substrate, and other preparatory Work.

a. Review structural loading limitations of storage and work areas.

b. Review Contract Documents.

c. Review status of Submittals.

d. Review Intent to Warrant and unexecuted Warranties.

e. Review Construction Schedule and verify availability of materials, Installer's personnel, equipment, and facilities.

2. Record discussions of conference, including decisions, agreements and unresolved issues. When unresolved issues exist at conclusion of conference, determine how they shall be resolved and set date for reconvening conference.

PART 2 - PRODUCT

2.1 ICE: ICE MACHINE

A. Product Description.

1. Unit shall be compact, free-standing ice flaker with minimum of 250-pound capacity self-contained insulated storage bin.

2. Unit shall be capable of producing a minimum of 478 pounds of ice per day (24 hours) at an ambient room air temperature of 70°F and a water inlet temperature of 50°F.

B. Overall Dimension:

1. 38-inches W Max. x 42-inches H Max. x 28-inches D Max

C. Construction:

1. Exterior: Unit exterior cabinet and hardware shall be constructed of corrosion resistant Stainless Steel. Unit shall be provided with four (4) 6-inch fixed legs.

2. Interior bin shall be fabricated of material producing a sanitary interior resistant to scratches and scuffs.

3. The ice making mechanism shall have a heavy duty, hermetically sealed compressor; automatic expansion valve refrigerant control; safety control thermostat to turn off ice maker should inlet water pressure become insufficient for ice production or if storage bin reaches maximum capacity.

4. Evaporator to be a close tolerance brass cylinder with brass shell, stainless steel auger, completely insulated with polyurethane foam. Auger shall be powered by belt-driven single reduction gear.

5. All machine components shall be easily accessible from a slide-out module for maintenance and servicing.

6. Refrigerant – R404-A, unit shall include a low refrigerant switch.

7. Automatic systems flush upon activation of bin control.

8. Removable and cleanable air filter.

9. Condensing unit shall be air-cooled.

10. Accessories:

    a. Ice scoop.

    b. Water filtration unit. (Ever pure Insurice model #EV9324-01); Filter body material shall be “Stainless Steel”.

    c. Additional replacement filter.

    d. Plug wire.

D. Utility Requirements:

1. Elect: 1/60/115V/ 12.5 amps (plug)

2. CW: 1/4-inch male flare. (Filtered supply).

3. Drain: 2-inch; Indirect

E. EQUIPMENT SCHEDULE:

Equipment #	Comments
ICE	Flaker

F. Equipment item(s) shall be CFCI.

G. WARRANTY

1. Minimum two (2) year parts and labor and a five (5) year compressor warranty.

H. Unit(s) shall be equal to Hoshizaki. F-500 BAJ. Unit(s) manufactured by Ice-O-Matic and Scottsman shall be considered equal provided they meet requirements of this specification.

2.2 ST: STEAM STERILIZER (ELECTRIC CLEAN STEAM GENERATED)

A. PRODUCT DESCRIPTION:

1. Unit design shall allow for general purpose steam sterilization of unwrapped equipment, wrapped instruments and utensils, and liquids in vented or unsealed containers at temperatures ranging from 212 - 280°F. Temperature uniformity within chamber +/-1°F during cycles.

2. Overall Dimension

    a. Exterior: 39” W x 52” L x 77” H

    b. Interior Chamber: 26” W x 26”H x 39” L

B. CONSTRUCTION

1. Unit design shall meet or exceed ASME Code for Unfired Pressure Vessels, Section VIII (U-1 stamp of compliance): ASME Boiler and Pressure Vessel Code, Section IX; American Welding society (AWS); ASTM; ANSI; NEMA; NEC; OSHA.

2. Unit shall be designed to meet or exceed Federal Specification GG-SS-1340A; Underwriter's Laboratory (UL) as certified by Electrical Testing Lab (ETL); ASME Code, Section VIII, Division 1 (U-1 stamp of compliance); ASME Code, Section 1, Part PMB (with generator); NAFP-70 compliant; as well as ISO 13485:2016

3. Constructed of solid type 316L stainless steel with an internal polish of glass-bead finish or better and jacketing constructed of type 304 or 316L stainless steel.

4. Sterilizer vessel/chamber shall be ASME rated at 45 psig.

5. A data plate, welded to the vessel, shall bear the serial number, National Board Number and name of the approved sterilizer manufacturer. An ASME U-1 Form shall accompany each vessel.

6. Chamber completely insulated with minimum 1” mineral wool (or equal) chloride free, encased in a rigid removable sheet aluminum or stainless-steel housing or one (1) piece Velcro enclosed insulation sleeve/ blanket.

7. Chamber door shall be constructed of stainless steel with a layer of insulation placed between the door and its outer stainless-steel cover to minimize chamber heat transfer.

8. Steam Jacket piping shall be piped, valved, and trapped to receive generator supplied steam. Steam Jacket piping shall be constructed of stainless steel with threaded connections and unions for ease of service. include shutoff valve (manual), steam strainer, steam trap and pressure regulator. All piping connections shall terminate within the confines of the sterilizer and be accessible from one or both sides of the unit (refer to equipment schedule and layout drawing for service side

9. Clean steam to Chamber Piping (Process Piping): All steam to chamber, piping components (including but not limited to piping, valves etc.) shall be constructed of, no less than, 300 series stainless steel with NPT threaded connections.

10. All installations continuously silicone caulked around perimeter of fascia.

C. FEATURES

1. All serviceable components accessible shall be from the front and one side of the unit; where multiple units are installed; components shall be accessible from a common access isle.

2. Provide power operated vertical sliding or hinged submarine type doors with automatic sealing, safety interlocks. Refer to equipment schedule below for door type required.

3. Resistive Thermal Detectors (RTD) – RTD (Load Probe) shall be provided to sense and control temperature variations with the unit chamber and jacket space providing accurate control inputs and readouts throughout the cycle.

4. Automatic Utility Startup/Shutdown: Permitting slow cooling of the vessel and load. Shutdown is programmable to activate at the end of a designated cycle or time of day. Upon activation the control system shall automatically shut off all utility valves, conserving steam and waste. Restart of utilities shall be accomplished automatically by programming and/or manually. Different automatic programming shall be capable for each day.

5. Drain discharge cool-down system to reduce discharges to 140°F or less.

6. Provide with each unit:

   a. One (1) bottom perforated fixed shelf and one perforated extendible adjustable shelf.

   b. Provide One (1) Transfer carriage and One (1) load car with two perforated adjustable shelves as alternate.

   c. Provide stainless steel. closure panel and trim pieces at openings between adjacent walls/ceiling and sterilizer as required and/or indicated on drawings /equipment schedule herein.

7. Water Saving Control: RTD to control the amount of water used in condensing the exhausted chamber steam to sanitary floor drain.

8. Stand-alone electric 36kW stainless steel generator shall be mounted near the sterilizer. Water source shall be a maximum conductance of 1 microsiemen/cm, and a minimum specific resistivity of 1 megaohm-cm fed to electric clean steam generator, providing clean steam to the chamber for all processes. An automatic blowdown system shall be provided to allow for in place flushing of scale and debris from generator vessel. Generator shall be ASME certified and U1 Stamped.

9. Control Lockout: The control system shall sense and confirm by a signal the door seal is energized or engaged properly before a cycle can start. If during the cycle the signal is lost, the alarm shall activate, the cycle shall abort, and the chamber shall automatically and safely vent.

10. Pressure Relief Valve: Provide separate pressure relief valves for Jacket and chamber limiting the pressure buildup within the vessel not to exceed the rated design pressure. Pressure relief valves shall be directed to floor drains or to a dedicated exhaust vent provided by others.

D. PROGRAMMABLE CYCLE

1. Cycle Program Functions:

   a. Pre-vacuum Cycle: Efficient for high-volume sterilization of porous, heat and moisture stable materials at 250°F - 275°F.

   b. Gravity Cycle: Sterilization of heat and moisture stable goods at 212°F - 275°F and decontamination of bagged basic waste.

c. Liquid Cycle: Sterilization of liquids and media in vented glass or metal containers at 212°F - 275°F. Liquid cycle shall utilize the optimal solution cooling feature during exhaust phase to control the exhaust rate.

E. CONTROL SYSTEM

1. The PLC controlled automatic steam sterilizer equipped to employ both high vacuum (accomplished with a mechanical vacuum pump to achieve minimum 27" Hg in 5 minutes or less) and gravity displacement method of air removal.

2. PLC shall control all system functions, monitor system operations, visually and audibly alert operator of cycle malfunctions, and, on command, visually indicate chamber temperature and pressure. Integrity of piping and door seals monitored with preprogrammed leak test.

3. Thermal or Impact printer shall document and record each cycle's performance with such data as time and date that unit is opened, cycle number, set points and cycle selected. Ethernet port to download cycle data to a remote computer. All data from control system to communications port in ASCII format compatible with PC/ Windows support software. Data shall be printed at the start and completion of each cycle. Provide three (3) paper tape rolls and two (2) printer ribbons with each unit.

4. Provide 0.1 amps Form C dry contacts to communicate with building BMS system and send a signal when unit is turned on or off and a door is opened or closed.

5. The PLC control system shall control and monitor all sterilizer operations and functions. The control system shall be factory programmed with standard sterilizing cycles with the capability of adjustment to meet specific processing requirements. The following operating parameters shall be capable of adjustment.

   a. Cycle Configuration.

   b. Time Display and Printout Units.

   c. Access Code.

   d. Audible Signals.

   e. Print Format.

   f. Temperature Display and Printout Units.

   g. Pressure/Vacuum Display and Printout Units.

   h. Wireless service and diagnostic access

   i. Remote cycle monitoring capability

6. Touch-sensitive screen: Unit shall be provided with a color graphics display in which all sterilizer functions, including cycle initiation and cycle configuration, are operated by

pressing indicated areas of the display. Displayed information shall be clear, user friendly not requiring cross referencing of information.

7. Internal Battery: An internal battery back-up for all cycle memory for up to a minimum of ten (10) years. The battery backup system shall assure cycle memory is retained and cycle completion shall commence upon restoring power.

F. UTILITY REQUIREMENTS:

1.	ELECT1	1/110V; 10A; (Building Power Supply)
2.	ELECT2	3/480 VAC, 44A (Elect Steam Boiler)
3.	RO WATER	Max Conductance of 1 microsiemen/cm; Min. specific resistivity of 1 megaohm-cm
4.	COLD WATER	3/4" NPT; 50-70 PSIG Dynamic, peak flow 8gal/min.; Temp <70F
5.	DRAIN	3/4” NPT; Building Drain Min 2”
6.	SPECIAL	Dry contacts for BMS.

G. EQUIPMENT SCHEDULE:

Equipment #	Comments
ST	Single vertical sliding door, Recessed through one wall.

H. Equipment item(s) shall be CFCI.

I. WARRANTY

1. Unit shall carry a three (3) year warranty parts and labor; vessel to carry a fifteen (15) year parts and labor warranty.

J. Unit(s) will be equal to Primus Model B 26”x26”x39” Steam Sterilizer. Unit(s) manufactured by Beta-Star, Consolidated and Steris shall be considered equal provided they meet requirements of this specification.

2.3 UCW:UNDERCOUNTER GLASSWARE WASHER

A. PRODUCT DESCRIPTION:

1. Under counter or freestanding, fully automatic and programmable laboratory glassware washer/dryer designed to wash inside of small-necked laboratory glassware using injectors and open glassware using rotary spraying arms. Wash pump and hydraulic circuit provide a high flow rate and low-pressure delivery for thorough cleaning without breakage of washed items. Washer utilizes a forced air-drying system with electric heating element and blower. Through the use of a diverse range of racks, baskets, and accessories, the machine is capable of injection washing on multiple levels thereby,

minimizing footprint while maximizing wash/dry capacity. Load bearing drop-down door and extendable rack rails allow for loading of each wash level.

2. OVERALL DIMENSION

   a. Exterior: 24.1” W x 27.7” D x 32.1-36” H

   b. Interior Wash Chamber: 22.6” W x21.3” D x 24.8” H.

B. CONSTRUCTION

1. Body, Door, and Washing Chamber: #4 sanitary high-grade finish AISI 304L stainless steel construction throughout interior of washer and exterior panels.

2. Insulation: Aluminum-backed insulation and fiberglass thermal blanket.

3. Main Wash Pump: min. ¾ HP with capacity of 89.8 gal/min.

4. Drain Pump: capacity of 4.2 gal/min.

5. Detergent and Acid Additive Pumps: Peristaltic type dosing at a rate of 280 ml per minute.

6. Electric Water Heating (Standard): min. 6 kW, type 304 stainless steel electrical submersion heater elements provide heating up to 95°C.

7. Water Filters: Included in hoses and water inlet valves to prevent debris from entering wash chamber.

8. Double Filter System: In chamber to protect recirculation and drain pump, easily removed for inspection and cleaning.

9. Complete Service Panel Access: To heaters, safety relays and circuit breakers.

C. FEATURES

1. Washing Circuit: All components in contact with wash and rinse solutions made of stainless steel or other materials impervious to the effects of detergents, additives, and general laboratory chemicals.

2. Drying System: Electrical heating element and blower for quick drying in wash chamber.

3. Steam Condenser: Removes vapors and steam whenever chamber temperature exceeds 50°C (122°F) and directs all condensate, vapors and steam to drain.

4. Glassware Racks and Trays 34 sanitary high-grade AISI 304L stainless steel, removable, interchangeable on two rack levels, with full extension roller slides attached to rack/tray (only track members remaining in wash chamber when rack/tray removed), pinned in place for safety to prevent accidental roll-out.

5. Injectors: # 4 sanitary high-grade finish AISI 304L stainless steel, mounted in racks with headers inserted into water outlet on wall of chamber; star-shaped polypropinol feet and integral injector tips for protection of washed items; injectors threaded into rack for easy removal, cleanout, and replacement.

6. Rack-to-Column Connection Valves: Automatically opened when injector racks or spray arm racks are inserted into any level of the multi-level chamber.

7. Spray Arms: #4 sanitary high-grade AISI 304L stainless steel; mounted on top and bottom of chamber; racks and trays available with spray arms mounted on bottom, with headers inserted into water outlet on wall of chamber; easily disassembled for cleaning and maintenance.

8. Door: Front, drop-down, spring counterbalanced; capable of supporting full glassware load and functioning as a loading platform; double-wall construction without window; insulated to minimize noise and surface temperature.

9. Fully Extendable Load Bearing Arms: Support jet racks for easy loading and unloading of glassware.

10. Tested for compliance with EC Electromagnetic Compatibility Directive.

11. Alarm conditions displayed in plain language with clear definition, not requiring reference to operation manual for interpretation of codes.

12. Water Temperature: Capable of heating up to and maintaining min. 195°F for a minimum of 30 minutes.

13. Automatic intake and dispensing of liquid detergent with independent adjustable dosing times for each prewash and wash cycle.

14. Automatic intake and dispensing of liquid acid rinse additive with adjustable dosing times.

15. Automatic self-diagnosis of mechanical and electrical malfunctions with audible and visual alarms, including automatic monitoring of fill and drain time to detect possible malfunctions that could result in overflow.

16. Door safety interlock acts as a fail-safe by removing power from machine output components when door is in the open position.

17. Sensor control for water level inside machine to prevent overflow.

18. Door lock prevents interference with wash cycle once it is in operation.

    a. Rack Capacity: 2 racks simultaneously, 2 interchangeable rack locations with automatic rack-to-column connection valves.

    b. Rotating Spray Arms: 1 located at top and 1 located at bottom of wash chamber

D. MICROPROCESSOR CONTROLS

1. Capable of storing 20 user-definable programs with up to 54 functions per program; 4 factory-preset programs.

2. All machine parameters are password protected.

3. Wash Cycle Program Functions

   a. Prewash: 0 to 3 cycles, at up to min. 195°F, of 0 to 30 minutes each, 0 to 6 of minutes liquid detergent addition at 280 ml/min. Programmable for cold or RO (reverse osmosis) water.

   b. Wash: 0 or 1 cycle, at up to min. 195°F, of 0 to 30 minutes, 0 to 6 minutes of liquid detergent intake at 280 ml/min. Programmable for cold or RO (reverse osmosis) water.

   c. Running Water Rinse Number 1: 0 to 9 fill, 30 second rinse and drain cycles. Programmable for cold or RO (reverse osmosis) water.

   d. Acid Rinse: 0 or 1 cycle of 0 to 30 minutes, 0 to 6 minutes (1,680 ml) of liquid acid rinsing additive intake at 280 ml/min. Programmable for cold or RO (reverse osmosis) water.

   e. Running Water Rinse Number 2: 0 to 9 fill, 30 second rinse and drain cycles. Programmable for cold or RO (reverse osmosis) water.

   f. Cold Purified (RO) Water Rinse: 0 to 1 cycle of 0 to 30 minutes each. Programmable for cold or RO (reverse osmosis) water.

   g. Hot Purified (RO) Water Rinse: 0 or 1 cycle, at up to min. 195°F, of 0 to 30 minutes. Programmable for cold or RO (reverse osmosis) water.

   h. Drying Time: 35 minutes.

E. CONTROL PANEL AND DISPLAY

1. Unit shall be equipped with a solid-state control system consisting of “START” button, and indicator light mounted on the exterior access panel.

2. Control Panel Keypad:

   a. Power button to turn washer on and off.

   b. Numeric keyboard to select wash program.

   c. Start button to start wash cycle.

   d. Key button to confirm information when in programming mode.

e. Number “1” button to display current temperature and programmed temperature.

f. Number “2” button to display phase, sequence and cycle times.

g. Number “3“button to display phase and status.

h. Start button to display Relay 1 to 8 statuses during wash cycle.

F. Upper and lower racks, of Type 304 stainless steel. Upper rack has additional wash arm and side release latches for easy lift out. Racks accommodate a variety of inserts for holding beakers, culture tubes and other specialty glassware (inserts/racks sold separately).

1. Manufacturer is to provide at the time of bid a complete list of rack inserts and accessories and include unit prices.

2. Manufacturer is to provide an allowance of $5,000 per unit for rack inserts and accessories to be selected by owner.

G. UTILITY REQUIREMENTS:

1.	ELECT	1/60/115V; 16A. (Dedicated 20A circuit Req’d)
2.	HOT WATER	3/4" - 11 1/2" GHT hose fitting; Water pressure betw 20-120PSI
3.	PURE WATER (RO)	3/4-11 1/2 GHT hose fitting. flow rate .9 gal/min, 29-87 psi.
4.	DRAIN	Standpipe/Tubing 5/8” ID or larger; Air gap recommend.

Drain hose (.57” diameter) tubing or pipe, 5/8" ID or larger, should be provided for the building drain. The use of an air gap is strongly recommended to prevent siphoning of wastewater into the washer.

H. EQUIPMENT SCHEDULE:

Equipment #	Comments
UCW	Under-Counter Washer unit.

I. Equipment item(s) shall be CFCI.

J. WARRANTY:

1. Minimum two (2) year parts and labor.

K. Unit(s) will be equal to Labconco Undercounter SteamScrubber Glassware Washer. Unit(s) manufactured by Getinge Lancer, Miele, or Steelco shall be considered equal provided they meet requirements of this specification.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Project Site Verification of Conditions:

1. Substrates: Examine for conformance to requirements indicated for that substrate.

2. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of equipment.

3. Proceed with installation only after unsatisfactory conditions is corrected and in accordance with accepted submittals.

4. CONDITIONS: Report any deficiencies to Construction Manager prior to commencing Work.

5. CORRECTIONS: Perform corrections as directed by Design Professional.

6. ACCEPTANCE: Commencing Work constitutes acceptance of existing conditions. Any future work or re-work required because of deficient conditions shall be performed at no expense to Owner.

3.2 PREPARATION:

A. Protection: Protect existing work from damage.

B. Direct the location of concealed reinforcement of walls for anchorage as required.

3.3 INSPECTION:

A. Check for shipping damage. Reject units with scratches, dents or other defects that cannot be readily corrected.

B. Check job site to ensure that rough-ins and substrates are correct and that equipment shall fit as indicated on Equipment Drawings.

C. Do not proceed with installation until defects or oversights are corrected.

3.4 INSTALLATION:

A. Deliver equipment to the job site freight paid.

B. Uncrate all equipment and place in locations shown on Equipment Drawings. Remove all crating materials and packing debris.

C. Install all items in accordance with Manufacturer’s standards. Provide all accessories necessary for a complete installation.

D. Verify plumbing, ventilation and electrical connection requirements for all equipment and coordinate connections with work of Division 15 and 16.

E. General: Install equipment as required to:

1. Comply with manufacturer's written instructions.

2. Comply with approved submittals.

3. Comply with Coordination Drawings.

4. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework.

5. Securely attach access panels, where applicable, but provide for easy removal and secure reattachment.

6. Where equipment abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

3.5 ADJUST AND CLEAN:

A. Check operation and installation of equipment as necessary to meet Manufacturer's or these specifications (whichever is more stringent).

B. Installer shall replace items, which do not operate properly, have defacing marks or damage, which cannot be satisfactorily repaired as determined by the Owner's Representative. Replace parts at no cost to Owner.

C. Clean and polish equipment in accordance with Manufacturer's recommendation before and after demonstration for Owner. Leave ready for use with copy of instruction manual attached to equipment in a manner to be specified by Owner's Representative.

D. Each manufacturer shall submit with his Contract Price proposal an itemized list of available accessories for Owner's selection as part of this work. Provide unit prices for these accessory items; unit price cost shall be valid through entire construction period of project and for an additional 90 days after substantial completion.

3.6 SERVICE CONTRACT:

A. Each manufacturer shall submit a service contract for their piece of equipment and cost of same. Owner shall determine if contracts are to be accepted.

3.7 FIELD QUALITY CONTROL:

A. Field test installed equipment in accordance with "Performance Requirements" specified herein to verify compliance.

B. Adjust equipment, where applicable, exhaust fans, and building's HVAC system, or replace equipment and make other corrections until tested equipment perform as specified.

C. After making corrections, retest equipment that failed to perform as specified.

3.8 MANUFACTURER'S FIELD SERVICES:

A. Manufacturers Technical Field Representative shall visit the Project Site as follows:

1. During the initial start of Work and examination of substrates.

2. Periodically while the Work of this Section is in progress

3. Upon completion of the Work of this Section.

B. Field Representative shall prepare a report after each Project Site visit outlining general progress and any deficiencies or deviations. Submit the report to the Construction Manager within three (3) working days

3.9 PROTECTION:

A. Protect against soiling and deterioration during remainder of construction period

END OF SECTION

SECTION 115313 – CHEMCIAL FUME HOODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Equipment listed in this specification is classified by who furnishes (F) and installs (I) equipment items. All equipment in this specification shall be Owner Furnished / Contractor Installed (OFCI)

1.02 SUMMARY

A. This Section includes the following:

1. Bench-top laboratory fume hoods.
2. Fittings for piped services and electrical service fittings in fume hoods.
3. Piping and wiring within fume hoods for service fittings, light fixtures, blower switches and other electrical devices.
4. Shop and field testing of fume hoods.

B. Related Sections include the following:

1. Division 6 Section for wood blocking for anchoring fume hoods.
2. Division 9 Section for reinforcements in metal-framed gypsum board partitions for anchoring fume hoods.
3. Division 9 Section for resilient base applied to fume hood base cabinets.
4. Division 12 Section "Laboratory Casework” for fume hood base cabinets.
5. Division 23 Section "Testing, Adjusting, and Balancing".
6. Division 23 Sections for fume hood duct connections, including ducts.
7. Division 22, 26 & 27 Sections for connecting service utilities at back of fume hoods. Piping and wiring within fume hoods are specified in this Section.

1.03 DEFINITIONS

A. “Service Fixtures” are defined as gas, air, and vacuum cocks, hot, cold, reagent grade water faucets, remote control valves, electrical receptacles with necessary flush mounting boxes, conduits or pedestals and plates, fluorescent and/or incandescent light fixtures, light switches and/or motor switches for hoods and other items which serve as a functional part of the equipment.

B. “Service Lines” are defined as gas, air, vacuum, hot, cold, reagent grade and reference grade water piping, drain lines, fittings and shut off valves necessary to carry respective services from building roughing-in floors or walls through equipment to “service fixture”.

C. "Service Lines" also include conduit, junction boxes, conduit fitting, wire disconnect switches and fuse or circuit breakers necessary to carry electrical services from building roughing-in outlets in floors or walls through equipment to "service fixtures."

1.04 EXCEPTIONS TO DRAWINGS AND SPECIFICATION

A. All exceptions shall be subject to written approval prior to receipt of bid. If no written communication is received prior to receipt of bid and approval indicated in an addendum, it is assumed that bidder will be in total compliance with specifications and will be held responsible for default or delay, regardless of any statement to the contrary in their written proposal.

B. Requests for a substitution must be made directly to the Owner's Representative's office for consideration no later than fifteen (15) working days prior to bid receipt date. Fume Hood ASHRAE Test Reports and confirmation of load performance for stands certified by an independent nationally recognized testing laboratory shall be submitted along with the request for a substitution.

C. Requests for a substitution following the bid opening will be rejected.

D. Substitutions approved prior to bid date will be handled as an addendum and be sent to all bidders.

1.05 PERFORMANCE REQUIREMENTS

A. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110 at a release rate of 4.0 L/min.:

1. Average Face Velocity: 100 fpm plus or minus 10 percent with sashes at 18" position. Fume hood will be operated at 80 to 100 fpm.

2. Face Velocity Variation: Not more than 10 percent of average face velocity.

3. Sash Position: Fully open.

a. Test hoods with vertical sashes set at 18" open.

b. Test hoods with combination sashes fully lowered, with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.

4. As-Manufactured (AM) Rating: AM 0.05 (0.05ppm).

5. As-Installed (AI) Rating: AI 0.05 (0.05ppm).

6. Test Setup Modifications: Conduct tests with a minimum of 3 and a maximum of 5 people in the test room and with two 1-gal. (3.8-L) round paint cans, one 12-by- 12-by-12-inch (300-by-300-by-300-mm) cardboard box, and three 6-by-6-by-12- inch cardboard boxes in the fume hood during the test. Position items from 6 to 10 inches behind the sash, randomly distributed, and supported off the work surface by 2-by-2-inch.

7. Walk-by Test: At the conclusion of containment test, execute 3 rapid walk-bys at 30-second intervals, 12 inches (300 mm) behind the manikin. Test-gas concentration during each walk-by shall not exceed 0.1ppm and shall return to specified containment value within 15 seconds.

B. Static-Pressure Loss: Not more than 3/8-inch wg at 100-fpm face velocity when tested according to Paragraph 6.4.2.4 in SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices."

C. Seismic Performance: Provide fume hood anchorages capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

D. Electrical Performance: UL 1805 Classified

1.06 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements.

2. Indicate locations and types of service fittings together with associated service supply connection required.

3. Indicate duct connections, electrical connections, and locations of access panels.

4. Include roughing-in information for mechanical, plumbing, and electrical connections.

5. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.

6. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.

7. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples: for Initial Selection: For factory-applied finishes epoxy countertops and stainless-steel countertops.

D. Samples for Verification: For factory-applied finishes, interior lining and countertop material, in manufacturer's standard sizes.

E. Product Test Reports: Based on evaluation of comprehensive tests according to SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices" and ASHRAE 110 performed by manufacturer and witnessed by a qualified independent testing agency, for fume hoods.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain laboratory fume hoods through one source from a single manufacturer.

1. Obtain through same source as laboratory casework specified in Division 12.

B. Product Standard: Comply with SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices."

C. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.08 DELIVERY, STORAGE AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. It is the fume hood manufacturer’s responsibility to verify field measurements and that equipment will fit through entryways, corridors and door openings enabling a smooth flow of equipment to its proper location in the building.

1.10 COORDINATION

A. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

PART 2 - PRODUCTS

2.01 PRODUCT DESCRIPTION:

A. Provide fume hoods with restricted compensating bypass above sash, which opens after sash is closed to less than 40 percent open. Design bypass to maintain sufficient exhaust air volume through hood to adequately dilute hazardous fumes regardless of sash position. Restricted bypass shall be configured as herein specified.

B. Variable-Air-Volume Control: Fume hoods shall be variable volume. All controls and alarms shall be furnished and installed by Division 23. Fume hood manufacturer shall be responsible for coordinating the location and cut-out required for supplied alarm with Division 23.

C. Overall Dimensions:

1. FUM5: 60” W x 39"D x 96”H; (height dimension includes base cabinet.)

2. FUM5.A: 60” W x 39"D x 96”H; (adjustable height dim. includes base cabinet.)

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products (barrier free benchtop fume hoods) by one of the following:

1. Acceptable Barrier-Free (ADA) Fume Hood Models:

a. ICI Scientific (Jamestown): Isolator ADA Hood with trough: F-960 (Vertical Sash) or F-961 (Combination Sash)

b. Labconco Corporation. Protector XStream

c. Mott Manufacturing: Safeguard

2. Acceptable General purpose Fume Hood Models:

a. Bedcolab: Vanguard Standard Hood

b. ICI Scientific (Jamestown): F-100 Isolator Gen-5

c. Kewaunee : Supreme Air H05

d. Labconco: Protector XStream

e. Mott Manufacturing: Pro Restricted Bypass or Safeguard

2.03 MATERIALS

A. Steel Sheet: Cold-rolled commercial steel sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

B. Stainless-Steel Sheet: ASTM A 666, Type 304; stretcher-leveled standard of flatness.

C. Glass-Fiber-Reinforced Polyester: Polyester laminate complying with ASTM D 4357, with a chemical-resistant gel coat on the exposed face and having a flame-spread index of 25 or less per ASTM E 84.

D. Epoxy: Factory molded of modified epoxy-resin formulation complying with Division 12 Section Wood Laboratory Casework and having a flame-spread index of 25 or less per ASTM E 84.

E. Laminated Safety Glass: ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality q3 with clear, polyvinyl butyl interlayer.

F. Fasteners: Interior fastenings are to be concealed. Exposed screws or screw head caps as not acceptable.

2.04 RESTRICTED BYPASS FUME HOODS

A. Provide fume hoods with partial compensating bypass above sash, which opens after sash is closed to less than 40 percent open. Design partial bypass to maintain sufficient exhaust air volume through hood to adequately dilute hazardous fumes regardless of sash position. Restricted bypass shall be configured as hereinafter specified.

1. Variable-Air-Volume Control / Constant-Air Volume Control: See Fume Hood Schedule on Drawing set for Volume control design. All controls and alarms shall be furnished and installed by other sections of this specification.

2.05 FABRICATION

A. General: Pre-assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of movement through a 41” x 83” door opening.

B. Steel Exterior: Fabricate from steel sheet, not less than 0.0478 inch thick (18 gauge), with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical- resistant finish to interior and exterior surfaces of component parts before assembly.

C. Ends: Fabricate with double wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

1. Access to fixture valves concealed in the wall shall be provided by exterior removable access panels and gasketed access panels on the inside liner walls. Exterior side panel member fastening devices to be exposed corrosion resistant, non-metallic material creating a positive mechanical latch. Exposed connectors to match hood body in color.

D. Access Opening Perimeter: Airfoil or streamlined shape with all right-angle corners radiused or angled. Bottom horizontal foil shall provide a nominal one-inch bypass when the sash is in the closed position. The bottom foil shall not be removable without the use of special tools. Bottom foil shall provide access area sufficient in size to pass through hospital grade electrical plugs. The bottom foil shall be steel with urethane powder coating to increase acid and abrasions resistance, except type 316 stainless steel, #4 finish. The airfoil and sill shall be flush with the height of the interior work surface. A secondary containment trough shall be located in front of the work surface and extend below the airfoil sill.

E. Fume hood liner: As noted on the Fume Hood Schedule.

1. Reinforced polyester panel, smooth finish and white color in final appearance. Flexural strength: 14,000 psi. Flame spread: 15 or less per U.L. 723 and ASTM E84-80. Baffle must be same material as liner. Metallic baffles, brackets or supports on hood interior – not acceptable.

F. Baffles: Baffles providing controlled air vectors into and through the fume hood must be fabricated of the same material as the liner. Provide minimal exhaust slots full height on vertical sides of the baffle. High performance 2-piece baffle will be used. Baffle shall incorporate exhaust slots located to purge the upper and lower area of the hood. Baffle to be non-adjustable. Baffles with manual or automatic adjustment are not acceptable. Minimum depth of 19" for interior workspace is required at the extreme upper portion of the fume hood to provide maximum interior work area. All baffles, supports, and brackets to be non-metallic.

G. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.

1. Duct-Collar Material: 4” high stainless-steel type 316 collar spun to create a bell mouth configuration. Provide stainless steel transition if manufacturer’s standard exhaust collar does not meet this requirement. Engineer shall determine the specific outlet diameter.

H. Restricted bypass shall enter hood through top of bypass chamber and enter the hood in a down-flow direction. The chamber shall protect the user from expelled particulate in the event of an adverse internal reaction.

I. Sashes: Provide operable sashes of type indicated on Fume Hood Schedule.

1. Vertical (or Combination) sash access with a 35” high sight line. Sash shall be top hung on nylon-tired stainless steel ball bearing wheels. Sash frame on bottom and sides must be no more than 1.5” thick and radiused to minimize turbulence. Area above the 28” high vertical sash opening shall be glazed with 3/8” thick laminated safety glass.

2. Counterbalance system: Single weight, sprocket and chain, counterbalance system which prevents sash tilting and permits ease of operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full length of operating sash opening. Design system to hold sash at any position without creep and to prevent sash drop in the event of cable failure. Open and close sash against rubber bumper stops.

3. Airfoil: The airfoil will be flush to the work surface with ample room for electrical hospital grade cords to fit beneath the airfoil. Sill to be ergonomically radiused on front edge. Sill must pivot forward to provide cord and trough access. Airfoil sills that are not flush with the top plane of the work surface are not acceptable.

J. Sash: Sash shall be designed to promote usage as an upper body and face shield. Face velocities and volumes shall be based on an 18” operating opening. Sash shall have the capability to be raised to full 28.5” vertical opening for loading or unloading of large apparatus. A lock-open shall be provided. Sash shall lower automatically to the operating position when released from any position above 18”.

1. Fabricate from 0.0500-inch- (1.3-mm-) nominal thickness stainless steel. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U- shaped gaskets.

2. Glaze with 7/32” thick laminated safety glass.

3. Counterbalance vertical sliding sash with sash weight and stainless-steel cable system. Provide ball-bearing sheaves, plastic glides in stainless-steel guides, and stainless-steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.

K. Light Fixtures: Provide vapor proof, two-tube, LED light fixtures, of longest practicable length; complete with tubes at each fume hood. Shield tubes from hood interior with 1/4-inch-thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets.

L. Base Cabinets and Tabletop: Shall be furnished under Division 12 Section “Laboratory Casework”. Provide base table with adjustable height legs to accommodate height range indicated on the drawings.

M. Countertops As labeled on drawings.

1. Resin Countertops: Fabricate with front overhang of 1 inch over base cabinets, continuous drip groove on underside 1/2 inch from edge, and factory cutouts for sinks.

a. Countertop Material: Black Epoxy Resin, uniform throughout full thickness.

b. Countertop Configuration: Raised (marine) edge, 1-1/4 inches thick at raised edge, with rounded edge and corners.

N. Filler Strips: Provide as needed to close spaces between fume hoods and adjacent building construction. Fabricate from same material and with same finish as fume hoods. Filler strips shall match in size any fillers associated with base cabinetry furnished under Section 12345. Filler strips shall be ‘slip fitting’ at adjustable height fume hoods.

O. Comply with requirements in Divisions 22,23,25 & 26 Sections for installing laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated. Electrical devices shall be GFI.

2.06 CHEMICAL-RESISTANT FINISH

A. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Chemical-Resistant Finish: Immediately after cleaning and pre-treating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

1. Colors for Fume Hood Finish: As selected by Architect

2.07 ACCESSORIES

A. Service Fittings: Comply with requirements in Division 12 Section Laboratory Casework

1. Provide service fittings with exposed surfaces, including fittings, escutcheons, and trim, finished with acid- and solvent-resistant, baked-on clear coating.

2. Service Valves shall be direct, front-loaded, Watersaver series L740 or equal per Division 22 specification.

B. Volume Controls, Airflow Indicators and Alarms shall be furnished by other trades and installed in the field. Review Divisions 23 & 25 for requirements. Provide cutouts and wiring access as required for installation by respective trades.

C. The exhaust air connection to the fume hoods shall be a flexible duct (McMaster-Carr BLO-R-VAC PVC hose Part No. 5666K46) for a 12-duct provided by Division 23 to allow height adjustment of the hood for ADA accessibility.

D. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 50 percent of sash height. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.

E. Electric Hydraulic Lift Base Stand: Provide an electric hydraulic lift base stand for Fume hood to be height adjustable for ADA accessibility. Range of height adjustment shall be 25.5″ – 33.5″.

2.08 SOURCE QUALITY CONTROL

A. Certify fume hood performance in compliance with ASHRAE 110, as manufactured, before shipment.

2.09 Utility Requirements:

A. E 1/60/120V; 20A (Standby required for Flow Monitor / Alarm by Div. 23)

B. A 1/4-inch diameter piping

C. V 1/4-inch diameter piping

D. Exhaust 12.8-inch ID.; approx. 595 cfm @ 0.12 SP (18” sash opening)

PART 3 - PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fume hoods according to Shop Drawings and manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Comply with requirements in Division 12 Section Wood Laboratory Casework for installing fume hood base cabinets, countertops, and sinks.

3.03 FIELD QUALITY CONTROL

A. Field test installed fume hoods according to modified ANSI/ASHRAE Standard 110- 2016 in accordance with Part 1 "Performance Requirements" Article to verify compliance with performance requirements.

1. NFPA 45 requires that fume hoods be field tested when installed.

2. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.

a. Tracer gas detection (capture) test is required on one (1) fume hood of each type specified on the project. A required tracer gas performance of AM 0.05 (parts per million) or better at a tracer gas release rate of 4.0 liters per minute.

b. Hood Static Pressure: Take traverse readings to measure exhaust rate and measure the hood static pressure. The hood shall meet as installed “static” and “sash movement” leakage tests and achieve less than 0.05ppm test rating.

3. All testing data, including instrumentation and equipment, and test conditions shall be provided on a report, including the average face velocities, and a separate graph- type performance curve on all tracer gas tests for all required fume hood widths.

4. After making corrections, retest fume hoods that failed to perform as specified.
5. Performance testing shall be conducted by an independent testing agency and by a specific individual certified to perform such tests by the National Environmental Balancing Bureau (NEBB).

3.04 ADJUSTING AND CLEANING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

3.05 WARRANTY

A. In accordance with Division 1 General and Supplementary General Conditions, furnish a written warranty the Work performed under this section to be and remain free from defects as to materials and workmanship for a period of one (1) year from date of acceptance. Defects in materials and workmanship that may develop within this time are to be replaced without expense to the Owner.

END OF SECTION

SECTION 122400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior motorized roller shades.

B. Motor controls.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

C. Sequencing:

1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

E. Selection Samples: Include fabric samples in full range of available colors and patterns.

1. Motorized Shades: Include finish selections for controls.

F. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.

G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum 5 years of documented experience with shading systems of similar size and type.

1. Manufacturer's authorized representative.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Shade Hardware: One year.
2. Electric Motors: One year.
3. Electronic Control Equipment: One year.
4. Fabric: One year.
5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 Manufacturers

A. Interior Motorized Roller Shades, Motors and Motor Controls:

1. Draper, Inc; Motorized FlexShade AC: www.draperinc.com/#sle (Basis-of-Design).
2. Hunter Douglas Architectural; RB500 Motorized Roller Shades: www.hunterdouglasarchitectural.com/#sle.
3. Drapery Industries; Blueshade: www.draperyindustries.com/#sle.
4. MechoShade Systems LLC; UrbanShade Single Roller - Motorized: www.mechoshade.com/#sle.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 Roller Shades

A. General:

1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.
3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
    a. Comply with NFPA 70.
    b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
    c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.

B. Interior Roller Shades - Basis of Design: Draper, Inc; FlexShade AC: www.draperinc.com/#sle. (Basis-of-Design)

1. Description: Single roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
    a. Drop Position: Regular roll.

b. Roll Direction: Roll down, closed position is at window sill.
c. Mounting: Window jamb mounted - inside, between jambs.
d. Size: As indicated on drawings.
e. Fabric: As indicated under Shade Fabric article.

2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
3. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
   a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
   b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
4. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
5. Shade Motor: Standard 120V AC motor, located as indicated on drawings.
6. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; clear anodized finish.
      1) Color: Black.
   b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 Shade FABRIC

A. Fabric for Room-Darkening Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.

1. Material: Vinyl coated fiberglass.
2. Performance Requirements:
   a. Flammability: Pass NFPA 701 large and small tests.
3. Openness Factor: 3 percent.
4. Weight: 14 ounces per square yard (397 grams per square meter).
5. Color: As selected by Architect from manufacturer’s full range of colors.
6. Fabrication:
   a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Digital Network Controls:

1. Intelligent Motors and Devices: Identifiable over network without separate interface.
2. Provide suitable interface modules as indicated or as required for connection to standard (nonintelligent) motors and devices.
3. Capable of reprogrammed control without requiring wiring modifications.

4. Capable of assigning shade motors to shade groups/sub-groups.
5. Capable of storing programmable open and close limits and minimum of three intermediate preset stop positions for each shade.
6. Capable of aligning adjacent shades within accuracy of plus/minus 0.25 inch (6.4 mm).
7. Provide 10 year nonvolatile power failure memory for system configuration settings.

D. Manual Controls:

1. Control Functions:
   a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
   b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
   c. Raise: Raise controlled shade(s) only while button is pressed.
   d. Lower: Lower controlled shade(s) only while button is pressed.
2. Wall Controls: Provided by shade manufacturer.
   a. Finish: White.

2.05 Roller Shade FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.

1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

B. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 123200 - MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured standard and custom casework, with cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 123600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.

1.04 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

D. BHMA A156.9 - Cabinet Hardware; 2020.

E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

1.05 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances, clearances required, and keying information.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Maintenance Data: Manufacturer's recommendations for care and cleaning.

G. Maintenance Materials: Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:

1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:

1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:

1. Ruptured, cracked, or stained finish coating.
2. Discoloration or lack of finish integrity.
3. Cracking or peeling of finish.

4. Delamination of components.
5. Failure of adhesives.
6. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Casework:

1. Institutional Casework Inc; www.iciscientific.com.
2. Labscape LLC; www.labscape.com.
3. Wood-Metal Industries; www.wood-metal.com.
4. Or Approved Equal.

2.02 CASEWORK, GENERAL

A. Quality Standard: AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Types: More than one type is required. See drawings for location of each type of casework.

C. Wood Veneer Faced Cabinets: Custom Grade.

2.03 FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Construction: As required for selected grade.

C. Structural Performance: Safely support the following minimum loads:

1. Base Units: 500 pounds per linear foot (744 kgs/linear m) across the cabinet ends.
2. Drawers: 125 pounds (57 kg), minimum.
3. Shelves: 100 pounds (45 kg), minimum.

D. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.

E. Hardware Application: Factory-machine casework members for hardware that is not surface applied.

F. Removable back panels on all base cabinets. Provide partial height back panels at sink cabinets.

G. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

H. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

I. Countertop Panel-Type Supports: Materials similar to adjacent casework, 1-1/2 inch (38 mm) in width, with front-to-back and toe space dimensions matching base cabinet. Designed to be secured in a concealed fashion to countertop material. Include two leveling devices per support panel.

2.04 WOOD-VENEER-FACED CASEWORK

A. Wood-Veneer-Faced Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.

1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
    a. Base Cabinets: 24 inches (610 mm).
    b. Wall Cabinets: 16 inches (406 mm).
3. Finishes:
    a. Exposed Exterior Surfaces: HPVA HP-1 Grade A, Ash, plain sliced, random-matched.
    b. Exposed Interior Surfaces: Thermally fused laminate.
        1) Color: White.
    c. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Ash, plain sliced, random-matched.
    d. Concealed Surfaces: Manufacturer's option.
    e. Matching Wood Grain Pattern: Comply with requirements of quality standard for specified grade and as follows:
        1) Provide center matched panels at each elevation.
        2) Provide sequence matching across each elevation.
    f. Factory-finish all exposed and semi-exposed surfaces with the same finish.
        1) Preparation: Wood sanded smooth, free from dust and mill marks.
        2) Coating: Clear, superior-quality, chemical-resistant acyclic urethane; applied in accordance with manufacturer instructions, force-dried, sanded and wiped clean.
        3) Coats: Multiple coats as required to achieve minimum 1.5 mil (0.038 mm) dry film thickness.
        4) Appearance: Clear satin gloss; not cloudy or muddy.

2.05 COUNTERTOPS

A. Countertops: See Section 123600.

2.06 CABINET HARDWARE

A. Comply with BHMA A156.9 requirements.

1. Acceptable base materials for plated finishes include steel.

B. Shelves in Cabinets:

1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.

C. Swinging Doors: Hinges, pulls, and catches.

1. Hinges: Concealed, number as required by referenced standards for width, height, and weight of door.
   a. Concealed Hinges: Installed in cabinet edge, and on door back, bright chromium plated over nickel on base material.
      1) European-Style Hinges for Overlay Doors: 110 degree opening angle.
2. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
3. Catches: Magnetic.

D. Drawers: Pulls and slides.

1. Pulls: Chrome wire pulls, 4 inches (102 mm) wide.
2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.07 MATERIALS

A. Wood-Based Materials:

1. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.

B. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.

C. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.

D. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

E. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.

F. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.08 ACCESSORIES

A. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

B. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.

C. Sealant for Use in Casework Installation:

1. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus composition.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Environmental Conditions:

1. Do not deliver casework until the following conditions have been met:
   a. Building has been enclosed (windows and doors sealed and weather-tight).
   b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
   c. Ceiling, overhead ductwork, piping, and lighting have been installed.
   d. Installation areas do not require further “wet work” construction.

B. For Base Cabinets Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 inch (13 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.

C. For Wall Cabinets Installation: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:

1. Maximum Variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

D. Verify adequacy of support framing and anchors.

E. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

C. Set casework items plumb and square, securely anchored to building structure.

D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
2. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch (3 mm) in 10 feet (3 m).
3. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).

F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

G. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.

H. Install hardware uniformly and precisely.

I. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

J. Replace units that are damaged, including those that have damaged finishes.

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework or countertops.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 123553.13 - METAL LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard and custom metal cabinets and cabinet hardware.

B. Mobile cabinets.

C. Wall shelving.

D. Fixed- and adjustable-height workbenches.

E. Adaptable laboratory furniture system.

F. Service space framing.

G. Service enclosures.

H. Acid storage cabinets.

I. Solvent storage cabinets.

J. Wall service panels.

K. Countertops.

L. Laboratory sinks.

M. Pegboards.

N. Laboratory emergency equipment plumbing fixtures.

O. Service fittings and outlets.

1.02 RELATED REQUIREMENTS

A. Section 224000 - Plumbing Fixtures: Non-laboratory sinks and emergency plumbing fixtures.

1.03 DEFINITIONS

A. Adaptable Laboratory Furniture System: Modular furniture assemblies consisting of individual components, including: support structures; cabinets and storage units; worksurfaces; shelving; accessories.

B. Mobile Cabinet: Free-standing base cabinet storage device mounted on casters or glides.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

E. ASTM C1036 - Standard Specification for Flat Glass; 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

H. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017 (Reapproved 2021).

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

L. NFPA 30 - Flammable and Combustible Liquids Code; 2024, with Amendment.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. SEFA 2 - Installations; 2010.

O. SEFA 3 - Laboratory Work Surfaces; 2020.

P. SEFA 7 - Laboratory Fixtures; 2021.

Q. SEFA 8M - Laboratory Grade Metal Casework; 2020.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of casework with related items.

1. Service Fixtures: Coordinate location and characteristics of service connections.

2. Equipment and Instruments: Coordinate installation of casework with equipment and scientific instruments.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Details of materials, component dimensions and configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware and keying, accessories, and service fittings, if any.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.

D. Samples For Color Selection: Color charts for each different finish material.

E. Test Reports: Independent laboratory reports showing compliance with chemical and physical resistance requirements for casework finish.

F. Manufacturer's Installation Instructions.

G. Maintenance Data: Manufacturer's recommendations for care and cleaning.

H. Maintenance Materials: Finish touch-up kit for each type and color of materials provided.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year warranty against defects. Complete forms in Owner's name and register with manufacturer. Covered defects include, but are not limited to:

1. Ruptured, cracked, or stained finish coating.
2. Discoloration, or lack of finish integrity.
3. Cracking or peeling of finish.
4. Weld or any other structural failure.
5. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Laboratory Casework:

1. (Basis-of-Design) Mott Manufacturing Ltd; Altus Bench System: www.mott.ca.
2. Institutional Casework Inc; Envision 4.0: www.iciscientific.com.
3. Kewaunee Scientific Corp; Enterprise Modular Workstation: www.kewaunee.com.

B. Countertops:

1. American Epoxy Scientific; www.epoxysci.com.
2. Durcon (Epoxy resin, Solid phenolic); www.durcon.com.
3. Symbiote Inc; Laboratory Countertops: www.symbiote.com.

C. Sinks:

1. American Epoxy Scientific; www.epoxysci.com.
2. Durcon (Epoxy resin, Polyolefin); www.durcon.com.
3. Symbiote Inc; Laboratory Countertops: www.symbiote.com.

D. Water and Gas Service Fittings:

1. Broen-Lab A/S; www.broen-lab.com/#sle.
2. Chicago Faucets, a Geberit company; www.chicagofaucets.com/#sle.
3. WaterSaver Faucet Co; www.wsflab.com/#sle.

E. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 METAL LABORATORY CASEWORK

A. Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.

1. Style: Flush overlay - square edge.
2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions.
   a. Tall Cabinets: 16 inch (406 mm).
   b. Upper Cabinets: 13 inch (330 mm).
3. Steel Sheet Metal:
   a. Gables, Front and Back Panels, Gusset Plates, Aprons, and Rails: 18 gauge, 0.0478 inch (1.21 mm) minimum thickness.
   b. Drawers, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 20 gauge, 0.0359 inch (0.91 mm) minimum thickness.
   c. Backing Sheet to Door and Door Fronts: 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.

4. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8M, provide components that safely support the following minimum loads, without deformation or damage:
   a. Tables: 300 pounds (136 kg) on four legs.
   b. Drawers: 125 pounds (57 kg).
   c. Shelves: 100 pounds (45 kg).
5. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
6. Edges and Seams: Smooth. Form counter tops, shelves, and drain boards from continuous sheets.
7. Shelf Edges: Turned down 3/4 inch (19 mm) on each side and returned 3/4 inch (19 mm) front and back.
8. Ends: Close open ends with matching construction.
9. Welding: Electric spot welded; joints ground smooth and flush.
10. Drawers and Doors: Fabricate drawer and door fronts of sandwiched sheets of sheet steel welded together and reinforced for hardware.
    a. Fill with sound-deadening core.
11. Shelves: Adjustable and fixed shelves formed down 3/4 inch (19 mm), returned back 7/8 inch (22 mm), and up 1/4 inch (6 mm) into a channel shape, front and rear; formed down 3/4 inch (19 mm) at each end. Shelves over 42 inches (1067 mm) long reinforced with a channel welded to underside of shelf.
12. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
13. Stainless Steel Finish: No.4, brushed finish.
14. Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.

B. Mobile Cabinets: Same construction as fixed base cabinets, with modifications.

1. Toe kick space eliminated.
   a. Cabinet underside reinforced with 14 gauge, 0.0747 inch (1.9 mm) minimum steel channels to provide caster mounting points.
   b. Four casters, each with a load rating of 165 pounds (74.8 kg).
2. For cabinets with drawers, include a counterweight to prevent the cabinet from tipping when one drawer is opened.
   a. Drawers rated at 50 pounds (22.7 kg), maximum.

C. Acid Storage Cabinets: Construction identical to other cabinets, with following exceptions:

1. Completely lined with corrosion-resistant liner material; stainless steel fasteners for all connections and hardware inside cabinet.
2. Shelves: Perforated or vented, rigid polypropylene.
3. Bottom Pan: Liquid tight, polypropylene liner covering entire bottom of acid storage cabinet.
4. Vent Kit: For connection to fume hood interior or ventilation system.

D. Solvent (Flammable and Combustible Liquids) Storage Cabinets: Construction identical to other cabinets, with following exceptions:

1. Construct to NFPA 30 and applicable OSHA requirements.
2. Fire Resistance: Maximum internal temperature of 325 degrees F (163 degrees C) at the center, and 1 inch (25.4 mm) from top of the cabinet when cabinet is subjected to a ten minute fire test that simulates fire exposure of a standard time-temperature curve specified in ASTM E119.
3. Steel sheet, 18 gauge, 0.0478 inch (1.21 mm) minimum thickness, double panel construction with 1-1/2 inch (38 mm) space between panels and electrical grounding connection.
4. Shelves: Full depth, adjustable sloped metal shelf.
5. Bottom Pan: 2 inches (50.8 mm) deep liquid-tight pan covering entire bottom of cabinet.
6. Cabinet Hardware: UL-listed.
    a. Manual-closing Doors: 180 degree opening. Three-point latch arrangement, self-latching when pushed closed.
    b. Door Handles: Manufacturer's standard, with slip-resistant grip.
7. Vents: Provide venting capable of achieving at least ten air changes per hour.
    a. Tie into building hazardous exhaust system.
    b. Vent Connections: 1-1/2 inch (38 mm) minimum diameter, corrosion resistant piping having flame spread index of 25 or less, when tested in accordance with ASTM E84.
    c. Provide minimum of two vents with fire arrestors for each cabinet.
8. Signage: Provide manufacturer's standard signage reading "FLAMMABLE - KEEP FIRE AWAY" or similar message in bright red color.

E. Wall Shelving: At locations indicated.

1. Adjustable Shelf Supports: Standard back-mounted system using single-slotted surface mounted stainless steel shelf standards, in lengths indicated, with coordinated cantilevered shelf brackets, No.4 finish, designed for nominal 1 inch (25 mm) spacing adjustments.
2. Shelves: 3/4 inch thick (19 mm thick) epoxy resin shelves in lengths indicated.
    a. Depth: 12 inches (305 mm).

F. Wall Service Panels: Designed to integrate into vertical gypsum board wall s for delivering multiple plumbing, electrical and data services.

1. Fabricated to fit in standard 24 inches by 48 inches (600 mm by 1200 mm) ceiling grids.
2. Enclosure Material: 18 gauge sheet steel with chemical-resistant finish specified herein.
3. Required Fitting Types: Quick-connect fittings and hoses.
4. Service Panel Types: Pre-punched panels accepting groups of services.
    a. Four-Station, 24 inches by 24 inches (600 mm by 600 mm) panel: Two (2) groups of two (2) service cutouts; One (1) service cutout for natural gas; Four (4) duplex receptacles cutouts; Two (2) data outlet cutouts.
5. Quick-Connect Fittings: Male and female types, suitable for service connected, 3/8 inch NPS (10 mm DN).
    a. Provide in up to eight different sizes (keys) to prevent connecting to wrong service.
6. Accessories:
    a. Service Hoses.

1) Reinforced PVC Hoses: Provide for non-burning gases, 3/8 inch NPS (10 mm DN) female inlet and 3/8 inch NPS (10 mm DN) male outlet. 72 inch (1829 mm) length.
2) Braided Stainless Steel Hoses: Provide for natural and reactive gases, 3/8 inch NPS (10 mm DN) female inlet and 3/8 inch NPS (10 mm DN) male outlet. 36 inch (914 mm) length.

b. Power Cords.
1) Single-circuit, 3-wire, 20 AMP/120 VAC, 36 inches (914 mm) long, with Standard Blade plugs.

2.03 ADAPTABLE LABORATORY FURNITURE SYSTEM

A. General: Modular component system incorporating and/or accommodating compatible metal laboratory casework items, including: cabinets, countertop frames, ledges and supporting structures.

B. Structural Modules: Primary support structures for adjustable work surfaces, shelving, utility delivery systems, and casework. Slotted channel design to provide support for components on 1 inch (25.4 mm) vertical increments.

1. Module Length(s): As indicated on drawings.
2. Module Height(s): As indicated on drawings.
3. Anchors and Brackets: For each structural support island, peninsula, and corner module; providing specified load-bearing capacity for the module, and resulting in a rigid, non-racking system.
   a. At Top: Mounting brackets or clip angles standard with the system manufacturer.

C. Worksurface Frames and Countertops:

1. C-Frames: Self-supporting frame capable of supporting the weights of the countertop and imposed loads, in addition to the weight of suspended base cabinets.
   a. Frame Length(s): 60 inches (1524 mm).
   b. Total Supportable Load: 600 pounds (270 kg), maximum, per frame.
   c. Provide channels for suspension of base cabinets at any point along their length.
2. Countertops: Include type(s) specified below.
   a. Material: Countertops made from epoxy resin.
   b. Cantilevered Countertop Front-to-back Dimension: 24 inches (610 mm) and 30 inches (762 mm).

D. Shelving: Modular units with integral brackets formed from metal sheets, with additional stiffener/reinforcing for units over 48 inch (1219 mm) long.

1. Typical Cantilevered Shelf Depth: 12 inches (305 mm).
2. Lengths: Coordinated with lengths of structural modules.
3. Shelf Material: Plastic laminate on top of standard metal.
4. End guards, 4 inch (102 mm) minimum height, where shelves do not abut walls or other shelf units.

E. Finishes:

1. Metal components: Same as other casework specified in this section.

2.04 CABINET HARDWARE

A. Manufacturer's standard styles, and as indicated below.

B. Finish of exposed stainless steel components: No.4 finish.

C. Shelves in Cabinets:

1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.

D. Wall-Mounted Shelving:

1. Shelf Brackets: Vertical satin chrome steel standards with satin chrome steel arms.

E. Swinging Doors:

1. Hinges: Offset pin, number as required by referenced standards for width, height, and weight of door.
2. Catches: Magnetic.
3. Pulls: Chrome-plated brass wire pulls, 4 inches (102 mm) wide.

F. Sliding Doors:

1. Pulls: Steel, recessed circular design.
   a. Steel Finish: Bright chromium plated over nickel on base material.
2. Track Assembly: Nylon track with solid bearing followers.

G. Drawers:

1. Pulls: Brass wire pulls, 4 inches wide (102 mm wide).
2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.05 COUNTERTOPS

A. Countertops:

1. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
   a. Flat Surface Thickness: 1 inch (25 mm), nominal.
   b. Surface Finish: Smooth, non-glare.
   c. Color: Black.
   d. Exposed Edge Shape: 3/16 inch (5 mm) radius corner.

e. Back and End Splashes: Same material, same thickness; separate for field attachment.

2.06 SINKS

A. Laboratory sinks (SK-A).

1. General: Manufacturer's adjustable support system for undermount sink installation.
2. Sink Type: Single-bowl.
   a. Material: Epoxy.
   b. Mounting: Undermount.
   c. Size: 18 inch (457 mm) wide by 15 inch (381 mm) front-to-back by 11 inch (280 mm) deep.
   d. Outlet: 1-1/2 inch NPS (40 mm DN) outlet with tailpiece.
      1) Placement: Center.

B. ADA Laboratory sinks (SK-B).

1. General: Manufacturer's adjustable support system for undermount sink installation.
2. Sink Type: Single-bowl.
   a. Material: Epoxy.
   b. Mounting: Undermount.
   c. Size: 18 inch (457 mm) wide by 15 inch (381 mm) front-to-back by 5 inch (127 mm) deep.
   d. Outlet: 1-1/2 inch NPS (40 mm DN) outlet with tailpiece.
      1) Placement: Center.

C. Non-laboratory sinks are identified on drawings and are specified in Section 224000.

2.07 PEGBOARDS

A. Epoxy pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable white polypropylene pegs. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inch (914 mm) long PVC drain hose.

1. Size: 18 inches wide by 24 inches high (457 mm wide by 607 mm high).

2.08 LABORATORY EMERGENCY EQUIPMENT

A. Plumbing Fixtures: See Section 224300 for emergency equipment plumbing fixtures not intended for installation in laboratory casework or for recessing into partitions.

B. General: Provide emergency equipment products complying with requirements of ANSI Z358.1.

C. Eye/Face Wash Units: Deck-mounted units.

1. Construction: Polished chrome-plated brass.
2. Twin eyewash heads with pop-off dust covers, internal flow control, and filter.
3. Type: 90-Degree horizontal-swivel, designed for mounting at either side of sink, with flag-handle activation.
    a. Plug-type valve designed to open orifice and activate water flow only when unit is swung down into operational position.
4. Sign: Manufacturer's standard ANSI-compliant identification sign.

2.09 SERVICE FITTINGS

A. General: Comply with requirements of SEFA 7.

B. Gas Service Fittings and Fixtures.

1. Laboratory Gas Fitting Type: N:
    a. Valve: Forged or cast brass body, 90 degree inlet - outlet configuration, with polished chrome with clear epoxy coating finish.
    b. Control: Ball valve.
    c. Mounting: Panel (vertical surface).
    d. Supply Gas: Nitrogen.
    e. Inlet: 3/8 inch NPS (10 mm DN) NPT.
    f. Outlet: Manufacturer's standard, with removable seven-serration hose end.
        1) Number: As indicated on Drawings.
    g. Handle: Manufacturer's standard four-arm handle with color-coded index disc.
2. Laboratory Gas Fitting Type: CO2:
    a. Valve: Forged or cast brass body, 90 degree inlet - outlet configuration, with polished chrome with clear epoxy coating finish.
    b. Control: Ball valve.
    c. Mounting: Panel (vertical surface).
    d. Supply Gas: Carbon Dioxide.
    e. Inlet: 3/8 inch NPS (10 mm DN) NPT.
    f. Outlet: Manufacturer's standard, with removable seven-serration hose end.
        1) Number: As indicated on Drawings.
    g. Handle: Manufacturer's standard four-arm handle with color-coded index disc.
3. Laboratory Gas Fitting Type: G:
    a. Valve: Forged or cast brass body, 90 degree inlet - outlet configuration, with polished chrome with clear epoxy coating finish.
    b. Control: Ball valve.
    c. Mounting: Panel (vertical surface).
    d. Supply Gas: Natural Gas.
    e. Inlet: 3/8 inch NPS (10 mm DN) NPT.
    f. Outlet: Manufacturer's standard, with removable seven-serration hose end.
        1) Number: As indicated on Drawings.
    g. Handle: Manufacturer's standard four-arm handle with color-coded index disc.
4. Laboratory Gas Fitting Type: AIR:
    a. Valve: Forged or cast brass body, 90 degree inlet - outlet configuration, with polished chrome with clear epoxy coating finish.

b. Control: Ball valve.
c. Mounting: Panel (vertical surface).
d. Supply Gas: Compressed Air.
e. Inlet: 3/8 inch NPS (10 mm DN) NPT.
f. Outlet: Manufacturer's standard, with removable seven-serration hose end.
1) Number: As indicated on Drawings.
g. Handle: Manufacturer's standard four-arm handle with color-coded index disc.

5. Vacuum Fitting Type: V:
a. Valve: Forged or cast brass body, 180 degree inlet - outlet configuration, with polished chrome with clear epoxy coating finish.
b. Control: Ball valve.
c. Mounting: Panel (vertical surface).
d. Inlet: 3/8 inch NPS (10 mm DN) NPT.
e. Outlet: Manufacturer's standard, with removable ten-serration hose end.
1) Number: Two.
f. Handle: Manufacturer's standard four-arm handle with color-coded index disc.

C. Water Service Fittings and Fixtures.

1. Water Fitting Type: CW and HW
a. Valve: Forged or cast brass body, 180 degree inlet-outlet configuration, with polished chrome finish.
b. Mounting: Deck (horizontal surface) turret base, with escutcheon.
c. Inlet: 3/8 inch NPS (10 mm DN) NPT.
d. Outlet: Manufacturer’s standard, with anti-splash serrated hose end.
1) Number: One
e. Handle: Manufacturer’s standard lever handle with color-coded index disc.
2. Pure Water Fitting Type: RO:
a. Valve: Forged or cast brass body, 180 degree inlet - outlet configuration, plastic lining, with polished chrome with clear epoxy coating finish.
b. Mounting: Deck (Horizontal surface) turret base, with escutcheon.
c. Inlet: 3/8 inch NPS (10 mm DN) NPT.
d. Outlet: Manufacturer's standard, with anti-splash serrated hose end.
e. Gooseneck: Rigid gooseneck, with 6 inch (153 mm) spread, anti-splash serrated hose end.
f. Handle: Manufacturer's standard self-closing lever handle with color-coded index disc.

D. Electrical Fittings and Fixtures:

1. Electrical Fittings, General: Types indicated, for mounting on laboratory casework, including, as appropriate, grounding screws, and mounting accessories and fasteners.
2. Electrical Power Fitting :
a. General: 3-wire polarized receptacles meeting requirements of NFPA 70.
b. Receptacles: Duplex, 5-20R, GFCI.
c. Orientation: Single face.
d. Voltage: 120 V.

e. Service: Normal power.
f. Receptacle Color: White.
g. See electrical drawings for circuiting.

2.10 MATERIALS

A. Sheet Steel: High-strength low-alloy, cold rolled and leveled unfinished steel sheet, ASTM A1008/A1008M, Class 1 (matte) finish.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.

D. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 3/16 inch (4.5 mm) thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.

E. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.

F. Sealant For Use in Casework Installation:

1. Manufacturer's recommended type.

2.11 FINISHES

A. Sheet Steel Finish: Having chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.

1. Coating Type, New Casework: Baked on epoxy; minimum two coats.
2. Color: As selected from manufacturer's standard selection.
3. Preparation: Degrease and phosphate etch, and prime.

2.12 ACCESSORIES

A. Undercabinet Task-Light Luminaires: LED luminaires, with switch and heavy-duty cord and plug.

1. Length: 18 inches (457 mm), nominal.
2. Illumination: 800 lumens, minimum.
3. Lens: Clear acrylic.
4. Finish: Baked enamel.
5. Color of Housing: Selected from manufacturer's standard range.

B. Gas Cylinder Brackets: Restraint safety assemblies for laboratory gas cylinders.

1. Regulatory Compliance: OSHA and NFPA.
2. Bracket Mounting: Wall, with fasteners.
3. Cylinder Capacity: Six
4. Cylinder Diameter Capability: 4 to 12 inches (102 to 305 mm).
5. Bracket Construction: 11 gauge, 0.119 inch (3.04 mm) hot-rolled steel.
6. Steel Finish: Polyester powder-coat.
7. Primary Restraint: 1-1/2 inch wide, 54 inches long (38 mm wide, 1372 mm long) polypropylene strap, with corrosion-resistant metal cinch buckle.
8. Secondary Optional Restraint: Manufacturer's standard metal chain set.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of support framing and anchors.

B. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.

B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

C. Set casework items plumb and square, securely anchored to building structure, with no distortion.

1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch (19 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.

D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).

F. Separate dissimilar metals to prevent galvanic action.

G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.

I. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

J. Vented Cabinets: Install in strict compliance with manufacturer's written installation instructions.

1. Install vent kits and connect to exhaust system.
2. Use only rigid materials for venting. No flexible materials permitted.
3. Plug vent openings in unvented cabinets with manufacturer's standard closure.

K. Replace units that are damaged, including those that have damaged finishes.

L. Coordinate installation of work of this section with installation of fume hoods and laboratory equipment.

M. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

N. Deliver sinks, cup sinks, and service fittings in properly marked boxes, accompanied with written instructions, for supervised installation by appropriate trade contractor(s).

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.

C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for manufactured casework.

B. Solid-surface trim and ledges.

1.02 RELATED REQUIREMENTS

A. Section 123200 - Manufactured Wood Casework.

1.03 REFERENCE STANDARDS

A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

G. SEFA 2 - Installations; 2010.

1.04 SUBMITTALS

A. See Section 013300 - Submittal Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

B. Quality Certification:

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.

2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   a. Manufacturers:
      1) Dupont: www.corian.com.
      2) Formica Corporation: www.formica.com.
      3) LG Hausys America, Inc: www.lghausysusa.com.
      4) Wilsonart: www.wilsonart.com.
   b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   d. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
5. Fabricate in accordance with manufacturer's standard requirements.

2.02 SOLID-SURFACE TRIM AND LEDGES

A. Solid Surfacing Trim and Ledges: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   a. Manufacturers:
      1) Dupont: www.corian.com.
      2) Formica Corporation: www.formica.com.
      3) LG Hausys America, Inc: www.lghausysusa.com.
      4) Wilsonart: www.wilsonart.com.
   b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   d. Color and Pattern: As indicated on drawings.
3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Fabricate in accordance with manufacturer's standard requirements.

2.03 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

B. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.04 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Apply sealer products in accordance with manufacturer's written instructions.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 Section Includes

A. Extruded aluminum entrance floor grilles.

B. Stainless steel entrance floor gratings.

1.02 Submittals

A. See Section 013300 - Submittal Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.

C. Shop Drawings: Indicate dimensions and details for recessed frame.

1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

D. Samples: Submit two samples, 12 by 4 inches (305 by 102 mm) in size illustrating pattern, color, finish, and edging.

E. Maintenance Data: Include cleaning instructions, and stain removal procedures.

PART 2 PRODUCTS

2.01 Manufacturers

A. Entrance Floor Grilles and Gratings:

1. Construction Specialties, Inc; Entrance Grids: Pedigrid G1: www.c-sgroup.com/#sle (Basis-of-Design).
2. Kadee Industries; KD38 Stainless Steel Grating: www.kadeeindustries.com/#sle.
3. Pawling Corporation; RG-400: www.pawling.com/#sle.

2.02 Entrance Floor Grilles and Gratings

A. Entrance Floor Grilles: Recessed extruded aluminum grille assembly with nominal 1 inch (25 mm) wide tread strips running perpendicular to traffic flow, slots between treads, and perimeter frame forming sides of recess; grille hinged for access to recess.

1. Recess Depth: 1-3/4 inches (44 mm).
2. Tread Surfaces: Nylon carpet.
3. Colors: To be selected by Architect from manufacturer's standard selection.
4. Length in Direction of Traffic Flow: As indicated on drawings.
5. Width Perpendicular to Traffic Flow: As indicated on drawings.

6. Frame: Anodized aluminum for embedding in concrete; minimal exposed trim; stud or hook concrete anchors.
7. Pan: Anodized aluminum bottom pan with drain, sealed to frame.

B. Mounting: Top of non-resilient members level with adjacent floor.

C. Structural Capacity: Capable of supporting rolling load of 400 lb (182 kg) without permanent deformation or noticeable deflection.

D. Vibration Resistant Fabrication: Welded, riveted, or bolted members; no snap or friction connections.

2.03 Fabrication

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

PART 3 EXECUTION

3.01 Installation

A. Install frames to achieve flush plane with finished floor surface.

B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION

SECTION 129300 - SITE FURNISHINGS

1.01 GENERAL

1.02 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all sections of Division 01-General Requirements which are hereby made a part of the specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.03 SUMMARY

A. Section Includes:

1. Bicycle racks.

B. Related Requirements:

1. Division 31 Section “Earthwork” for excavation and backfill.
2. Division 32 Section “Cement Concrete Pavement” for sidewalks and for filling bollards.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of exposed finish, not less than 6-inch- long linear components and 4-inch square sheet components.

C. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.06 PRODUCTS

2.01 See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Division 01 Section "Product Requirements."

2.02 BICYCLE RACKS

B. Subject to compliance with requirements, provide Bike Rack by Dero Bike Rack Co. or comparable product.

C. Product: Downtown Rack.

D. Bicycle Rack Construction:

1. Frame: 2” by 0.120” square tube.
2. Finish: Black thermoplastic.
3. Installation Method: Embedded.

1.07 EXECUTION

3.01 EXAMINATION

E. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION

SECTION 210500 - BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring.

Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final steam, condensate, hot water, chilled, drain connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of **laboratory equipment** and special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent, gas, air, vacuum, lab gas connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

END OF SECTION

SECTION 210523 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES

A. General: Valves shall have the following requirements:

1. Working pressure stamped or cast on bodies.

2. Stem packing serviceable without removing valve from line.

3. UL listed and FM approved and labeled for intended fire protection service. Sprinkler systems 175 WWP;

B. Acceptable Manufacturers:

1. Gate Valves: Kennedy, Mueller, Nibco, Stockham, Victaulic.

2. Butterfly/Ball Valves, Indicating Type: Grinnell, Kennedy, Milwaukee, Stockham, Victaulic.

3. Check Valves: Grinnell, Kennedy, Nibco, , Victaulic.

2.2 GATE VALVES

A. 2-1/2 in. and Larger: IBBM, resilient wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 200 WWP; Stockham Fig. G-610.

B. 2 in. and Smaller: Bronze body and bonnet, OS&Y, threaded ends, solid wedge, 175 WWP; Stockham Fig. B-133.

2.3 BUTTERFLY/BALL VALVE

A. 2-1/2 in. and Larger: Butterfly style, ductile iron body, lug type, aluminum bronze disc, stainless steel trim, EPDM seat, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, 200 WWP; Stockham #LD-72UF.

B. 2-1/2 in. and Larger: Butterfly style, ductile iron body, ductile iron disc coated with EPDM, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, grooved ends, 300 WWP; Victaulic Series 705W.

C. 2 in. and Smaller: Bronze body, threaded ends; indicating gear operator, provision for tamper switch; Milwaukee "Butterball".

2.4 CHECK VALVES

A. 2-1/2 in. and Larger: Ductile iron body, aluminum bronze or ductile iron disc coated with EPDM, hinged to a removable access cover for inspection and maintenance, stainless steel shaft and spring, grooved ends, 250 WWP; Viking Model G-1 Swing Check Valve.

B. 2 in. and Smaller: Bronze body, swing type, rubber faced, threaded ends; Grinnell #3315.

2.5 MISCELLANEOUS

A. Trim and Test Valves: Ball, plug, angle or globe type; bronze body; threaded ends; UL listed.

1. Ball Valves: Bronze two-piece body, full port, threaded ends, chrome plated ball, blowout proof stem, reinforced TFE seats, 300 psi working pressure, UL listed, FM approved; Nibco Model KT-585-70-UL.

B. Hose Thread Drain Valves:

1. Ball Valve: Bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all shutoff, check, drain and other type valves as required by Code as indicated and as required for proper system maintenance, isolation and safety.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide hose thread drain valves at all low points to enable complete drainage of all portions of the system.

D. Install valves per respective listing/approval.

E. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

F. Use ball valves for auxiliary drains.

G. Flushing full-port ball valves shall be provided on underground mains (inside the building) and above-ground mains, cross-mains, branch lines and run outs of new sprinkler systems (wet and dry), to facilitate any future periodic internal inspections, obstruction investigations and as-needed flushing work. Valves shall be sized per NFPA 25, in order to obtain the NFPA required minimum velocity of 10 ft/s for any given pipe size. As an alternative to the hydraulic calculation valve sizing method, the following sizing rules can be applied:

1-inch thru 2 1/2 inch pipe: line-size full-port ball valve

3-inch pipe: one (1) 2 1/2-inch ball valve

4-inch pipe: two (2) 2 1/2-inch ball valves

6-inch pipe: three (3) 2 1/2 inch ball valves

8-inch pipe: four (4) 2 1/2 inch ball valve.

END OF SECTION

SECTION 210553 - FIRE PROTECTION IDENTIFICATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATIONS

A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating code number, location and valve function. Submit schedule of pipe, equipment and name identification for review before labeling.

1.4 ACCEPTABLE MANUFACTURERS

A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Emedco, Industrial Safety Supply Co., Inc., Lab Safety Supply, Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 PIPING IDENTIFICATION

A. Identification Types:

1. Snap-on type: Provide manufacturer's standard pre-printed, semi rigid snap-on, color coded pipe markers, complying with ANSI-A13.1.

2. Pressure sensitive type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Fire Protection Water	FIRE PROTECTION WATER
Fire Sprinkler Water	FIRE SPRINKLER WATER

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between fire protection, heating and plumbing services with 1/4 in. letters above the valve number.

2. Equal to Seton Style No. M4507.

B. Provide a sign for each control, sectional and drain valve identifying the portion of the building served in accordance with NFPA 13. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.4 EQUIPMENT IDENTIFICATION

A. General:

1. Provide engraved vinyl nameplates for each major piece of mechanical equipment provided, 2-1/2 in. x 3/4 in. size.

2. Nameplates: Equal to Seton Style No. M4562.

2.5 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.

B. The color for all fire protection valves shall be RED.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide valve tags for all valves provided on project.

B. Provide piping identification with directional flow arrows for all piping on project, maximum every 20'-0" or piping installed through rooms, provide at least one pipe label in each room, for each pipe function.

C. Provide equipment tags for all equipment provided.

END OF SECTION

SECTION 211010 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.2 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 weight; black steel pipe; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded Fittings: Class 125, cast or malleable iron, black , as called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

a. Couplings: Ductile iron, ASTM A395 and ASTM A536, with painted coating, designed for rolled grooved piping,

b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.

c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.

d. Fittings: Elbows, tees, laterals, reducers, adapters as required shall be ductile iron conforming to ASTM A395 and A536. Fittings shall have grooves designed to accept grooved end couplings of the same manufacturer.

e. Victaulic, rigid system, Style 009 couplings cast with offsetting angle pattern bolt pads to provide system rigidity and support in accordance with ANSI B31.1 and B 31.9. UL listed and FM approved; 300 psi wwp; use a gasket and coupling system similar to Victaulic Flush-Seal for all dry type systems; follow all terms of listings/approvals.

f. Acceptable Manufacturers: Victaulic or approved equal.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
Up to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Adjustable steel clevis type for piping 4 in. and larger.

4. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.

C. Spacing Schedule (Maximum Distance between Hangers (ft.-in.):

NOMINAL PIPE SIZE (IN.)	**3/4**	**1**	**1-1/4**	**1-1/2**	**2**	**2-1/2**	**3**	**3-1/2**	**4**	**5**	**6**	**8**
Steel Pipe	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0
Copper Tube	8-0	8-0	10-0	10-0	12-0	12-0	12-0	12-0	15-0	15-0	15-0	15-0
Rod Size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2

D. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller, complying with NFPA 13.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements, complying with NFPA 13.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal, complying with NFPA 13 Supports:

1. For all piping larger than 2 in., provide intermediate structural steel members for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For weights under 1,000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.

4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

F. Hangers for fire protection piping as specified and in accordance with NFPA 13. Hangers and building attachments shall be UL listed and FM approved for fire protection service. Adjustable swivel ring type hangers are permitted for 3 in. and smaller piping.

2.4 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas.

B. All bushings and nipples required for instruments and gauges shall be brass.

2.5 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two (2) pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

2.6 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.7 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform to the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.8 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A" - Piping Materials at end of this Section for Fire Protection piping.

B. See Exhibit "B" - Testing at end of this Section for Fire Protection piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in size shall be made with reducing fittings.

Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required, to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting systems. Conceal piping unless otherwise called for.

B. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing.

C. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers on diesel engine exhaust piping where insulation/supports must pass between pipe and hanger.
Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor.

3.4 PIPE CONNECTIONS

A. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

B. Grooved Mechanical Joints: Pipes joined with grooved fittings shall be joined by a listed combination of fittings, couplings, gaskets and grooves of a single manufacturer. Lubricate and install gasket and couplings. Follow manufacturer's recommendations. Grooved ends shall be clean and free of indentations, projections and roll marks in the area from pipe end to groove.

3.5 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by qualified welder. Use certified welder where specifically required by code or insurance company. If indicated and permitted for fire protection systems, all provisions for welded pipe shall additionally be in accordance with NFPA Standard 13. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

3.6 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete.

Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior locations: Firmly pack with fiberglass and caulk.

2. Exterior walls above grade: Use sealing element.

3. Exterior walls below grade and above floors: Use sealing element.

4. Cored holes: Use sealing element.

5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

6. Waterproofed walls/floors: Use waterproof sealing element, device or compound.

3.8 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

A. Fire suppression systems shall be hydrostatically tested at 200 psi for two (2) hours in accordance with NFPA 13.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative and shall be justified by hydraulic calculations. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Sprinkler (wet)	Schedule 40, black steel, 2 in. and smaller	Cast or malleable iron	Threaded
	Schedule 40, black steel 2-1/2 in. and larger	Ductile iron	Roll grooved mechanical type couplings

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Sprinklers	Test hydrostatically at 200 psi for two (2) hours in accordance with NFPA 13.

END OF SECTION

SECTION 211300 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

A. Comply with the 2020 Fire Code of New York State, FM Global Data Sheets, Cornell University Cross Connection Control Program Manual, ANSI A-17.1, Safety Code for Elevators and Escalators, and referenced edition of the following National Fire Protection Association (NFPA) Standards:

1. NFPA 13: Standard for the Installation of Sprinkler Systems.

2. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

3. NFPA 72: National Fire Alarm Code.

4. NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations.

B. Follow all requirements, recommendations and appendices to comply with the latest edition of the following publications, codes, standards, and listings/approvals:

1. FM Global (FM) Approval Guide.

2. Underwriters Laboratories, Inc. (UL) Fire Protection Equipment Directory.

3. 2020 Fire Code of New York State.

4. OSHA Rules and Regulations.

5. Requirements of Insurance Underwriter and other Authorities Having Jurisdiction.

C. Equipment, devices, hangers and components shall be UL listed and FM approved and labeled for the intended fire protection service.

D. The fire protection work shall be performed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems.

E. Preparation of working plans, calculations and site observation of systems shall be completed by a NICET Level III technician under the direction of a qualified New York State Registered Professional Engineer.

1.3 SYSTEM DESCRIPTION

A. The fire protection system shall be a wet pipe or pre-action automatic sprinkler system arranged to properly protect spaces as indicated.

B. Water is supplied from a 12 in. municipal water main located at Hydrant H-154, through an 8 in. underground water main to the system's main riser. Water supply data at the municipal main as provided by the owner:

1. 82 psi static.

2. 20 psi residual with 3800 gpm flowing.

C. The flow test information above is submitted for information only. This contractor shall arrange for a new flow test on the municipal main prior to performing hydraulic calculations. The more restrictive of these two tests shall be used as the basis of design. Coordinate with CU for latest flow test.

D. Fire department connection(s) shall be provided to allow the servicing fire department to augment the system's normal automatic water supply.

E. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any Authority Having Jurisdiction.

F. Use of room design method will not be permitted. Calculations shall be based upon the specific hazard for the areas being protected. The following minimum requirements shall be provided as actually installed in the protected spaces.

1. Hazard Group HC-1: These areas shall include: Office Areas, Conference Rooms, Corridors, Classrooms.

a. Water density: .10 gpm/sq. ft.

b. Maximum coverage per sprinkler = 225 sq. ft.

c. Hydraulic remote area: 1,500sq. ft.

d. Interior hose demand: 0 gpm.

e. Exterior hose demand: 1

2. Hazard Group HC-2: These areas shall include Lab Spaces, Mechanical Rooms, Utility Rooms.

   a. Water density: .20 gpm/sq. ft.

   b. Maximum coverage per sprinkler = 130 sq. ft.

   c. Hydraulic remote area: 2,500 sq. ft.

   d. Interior hose demand: 0 gpm.

   e. Exterior hose demand: 250 gpm.

G. Maximum coverage for any sprinkler head shall not exceed NFPA or FM Global requirements or the listing for the sprinklers provided, whichever is more restrictive.

H. A minimum 10 psi safety factor shall be provided between the available municipal water supply curve and the total system demand point. The total system demand point shall be at the municipal water main and include the calculated sprinkler and interior hose stream demands plus the exterior hose stream demand at the residual pressure required for proper system operation.

I. The maximum flow velocity shall not exceed 20 ft. per second in the piping system and 15 ft. per second in mains with paddle type waterflow indicators.

J. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Waterflow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.

K. Provide 3/16 in. x 1 in. cadmium plated carbon steel chains and master keyed all brass case hardened padlocks to lock water supply valves in the proper position.

1.4 SUBMITTALS

A. Product Data:

1. Submit manufacturer's catalog cut, specifications and installation instructions for each item or component of fire protection system. Clearly indicate pertinent information such as, but not limited to:

   a. Manufacturer's model number.

   b. Materials, size, finish and type of connection.

   c. Pressure ratings of components.

   d. FM approval/UL listing.

B. Certification: Submit Contractor's NICET certification and number.

C. Samples:

1. If requested, submit sample of sprinklers.

D. Drawings and Calculations:

1. All drawings and calculations shall be signed and sealed by a New York State Registered Professional Engineer.

2. Submit complete NFPA 13/FM Global drawings and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Ithaca Fire Department, Cornell Environmental Health and Safety, Cornell Fire Protection Engineer, and FM Global. Contractor shall not commence with construction until all parties listed above have given their approval.

3. Submit hydraulic calculations for each design density/remote area with items in NFPA 13/FM Global Data Sheets incorporated including sketches to indicate flow quantities, sprinklers operating and direction of flow for pipes in looped and gridded systems.

4. Drawing shall be fabrication drawings provided to indicate actual sprinkler, standpipe and equipment layouts. Drawings shall be 1/4" = 1'-0" scale on reproducible sheets of uniform size. Drawings shall show all data required by NFPA 13/FM Global Data Sheets.

5. Submit drawings in one (1) complete package.

E. Record Drawings and Documents:

1. Submit Record Drawings, hydraulic calculations, test reports, and NFPA Above and Below Ground Material and Test Certificates to the Owner's Representative, Insurance Underwriter and other Authorities Having Jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Mixing of manufacturers or models of the same or similar component will not be acceptable.

2.2 FIRE DEPARTMENT CONNECTION

A. Storz quick connect type with 30 degree elbow, cap, chain and escutcheon labeled "AUTOSPKR".

1. 5 in. Storz x 6 in. NPT.

2. Polished chrome plated escutcheon, inlets, plugs and chains.

3. Design Equipment: Potter-Roemer Fig. No. 5795-01 connection with Fig. No. 5799-01 cap and chain.

B. Acceptable Manufacturers: Croker, Elkhart, Potter-Roemer, Engineer Approved Equal.

2.3 PRESSURE GAUGES

A. Water Pressure Gauge:

1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.

2. 0 to 300 psi range, in 5 psi increments with accuracy to meet ANSI B40.1.

B. Acceptable Manufactures: Reliable; FM approval shall be stamped on all pressure gauges.

2.4 SPRINKLERS AND ACCESSORIES

A. Brass or bronze, 1/2 in. orifice, 1/2 in. NPT. 155°F ordinary temperature classification for light and ordinary hazards. Use 286°F sprinklers in Mechanical, Electrical and Elevator Rooms; in vicinity of heat equipment/sources; and in accordance with NFPA 13.

1. Finished Ceiling Areas: Semi-recessed pendent sprinklers with matching two- piece escutcheon, color as selected by Architect of Record.

2. Unfinished Ceiling Areas: Natural brass/bronze finish pendent or upright sprinklers as required.

B. Sprinkler Types and Design Equipment:

1. Quick Response Pendent and Upright: Viking Microfast® Quick Response Pendent and Upright.

2. Quick Response Horizontal Sidewall: Viking Microfast® Quick Response.

3. Quick Response Extended Coverage Horizontal Sidewall: Viking Microfast® EC/QREC Horizontal Sidewall Sprinkler.

4. Sprinkler K-Factor shall be in accordance with FM Global Data Sheet No. 2-0.

C. Acceptable Manufacturers: Reliable, Victaulic, Viking.

D. Flexible Sprinkler Drops:

1. FM Approved braided Type 304 stainless steel tube with union joints, factory tested to 400 psi and listed for up to three (3) 90° bends including bracket for mounting to ceiling or building structure.

2. Design Equipment: Victaulic "VicFlex".

E. Sprinkler Guards:

1. Steel wire cage with base plate and retaining clamps. Same manufacturer as sprinkler.

2. Design Equipment: Viking Model D-1.

F. Sprinkler Cabinets and Spare Sprinklers:

1. Steel or aluminum construction with shelves and shell holes to accommodate the number of spare sprinklers required by NFPA 13.

2. Bright red finish with hinged front door and label.

3. Sprinkler wrenches compatible for each type used.

4. Spare sprinklers for each system of the type and proportion of those used in each system.

5. Design Equipment: Viking Model FPPI.

G. Acceptable Manufacturers: Viking, Reliable, Victaulic.

2.5 ALARM EQUIPMENT

A. Paddle Waterflow Detectors:

1. Adjustable retard feature, SPDT contacts, 24 volt DC, 250 psi rated.

2. Design Equipment: Potter Electric #VSR-AT.

B. Tamper Switches:

1. Integral with valve or separate device installed on valve to actuate alarm upon valve movement, steel enclosure, SPDT contacts, 24 volt DC, mounting brackets and hardware.

2. Design Equipment: Potter Electric #OSYSU (for OS&Y valves) and #PIVSU-A (for post indicator and butterfly valves).

C. Acceptable Manufacturers: Autocall, Potter Electric, System Sensor.

2.6 FLOOR CONTROL ASSEMBLY

A. Fire Protection control module with test and Drain valve. Integrate with ASR assemble.

1. Design equipment: Victaulic Series UM

2. Acceptable Manufacturers: Victualic or approved equal.

2.7 AUTOMATIC AIR VENTS

A. Automatic air vent with drip pan shall include 1/2 in. NPT isolation valve with forged brass body and stainless steel 20 mesh strainer, adjustable purge valve with hose connection, threaded cap and lanyard and automatic air release valve with conical body, recessed venting valve, single float on rigid shaft and bubble breaker. Drain piping shall be indirectly connected to the nearest sanitary floor drain.

1. Design Equipment: Potter ECS PAV-W.

2. Acceptable Manufacturers: ECS or approved equal.

2.8 SYSTEM COMPONENT IDENTIFICATION

A. At control, test and drain valves, provide permanently marked identification signs constructed of 18 gauge steel with baked enameled finish. The signs shall be permanently mounted on the piping or wall at the valve, or on the valve, but shall not be hung on the valve with wires or chains which permits easy removal of the sign. The sign shall clearly indicate the valve's purpose and what portion of the structure it serves. Additional signs, shall be provided at each alarm check and dry pipe valve to clearly indicate hydraulic calculation data.

2.9 ADDITIONAL SPRINKLERS AND SPRINKLER GUARDS

A. Include allowance for providing 12 additional sprinklers with related piping, fittings, hangers and 12 additional sprinkler guards installed at locations where job conditions or equipment selections may be required. Provide a credit for sprinklers and guards not installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.

B. Piping shall not pass directly over electric panelboards, switchboards, motor control centers, and similar electric and telephone equipment. However, protection for these spaces shall be provided.

C. Piping shall be installed concealed above finish ceiling area with sprinklers located in the quarter points of ceiling tiles where ceiling tiles are used.

D. Provide a control valve and readily removable flushing connection consisting of a cap at each end of cross mains and branchline piping.

E. Each sprinkler system shall be provided with an automatic vent valve located near the high point of the system in accordance with NFPA requirements.

F. Provide sprinkler guards for sprinklers in mechanical and storage spaces, less than 8 ft. above finished floor subject to mechanical damage.

G. Pipe ball drip valves at a floor drain or to the exterior. Pipe 2 in. main drains and water motor gong drains to discharge to the exterior at approximately 2 ft. above finished grade.

H. Securely install the spare sprinkler cabinets to the building wall at the main riser.

I. Inspector's test valves system auxiliary drains shall be installed 7 ft. or less above the finished floor.

J. Fire department connections shall be installed 3 ft. above finished grade and electric alarm bell approximately 7 ft. above finished grade (mounted directly above fire department connection).

K. Upright sprinklers directly on branch lines shall be installed with their frame parallel to the piping.

L. Provide sprinkler protection under ductwork, groups of ductwork and other obstructions to water spray and distribution. Use intermediate level sprinklers if subject to waterspray from above.

M. Exposed pipe shall be left clean for painting.

N. Coordinate and activate the systems or portions of the system to operational status as soon as possible.

3.2 PIPING, VALVES AND HANGERS

A. Refer to other applicable sections.

B. All piping shall be installed to permit drainage of the system through a main drain valve. Where a change in piping direction prevents drainage of the system, auxiliary drains shall be provided. The auxiliary drain assembly shall consist of a lockable ball valve, nipple and cap or plug and shall be located 7 ft. or less above the finished floor. Pipe drain to an accessible location.

3.3 TESTS

A. General:

1. Pipe installation shall be inspected by Owner's Representative prior to being covered by building construction or backfill.

2. Give the Owner's Representative advance notice of final tests. Perform tests in a safe manner. Provide written certification that tests have been successfully completed. Use NFPA Above and Below Ground Material and Test Certificate Forms.

3. Correct system leaks prior to final test. Do not utilize water additives, caulking, etc. to correct leaks. Provide appliances, equipment, instruments, devices and personnel.

4. Flushing: Follow Contract Documents and utilize open end pipe sections if possible.

B. Pressure Tests:

1. Hydrostatic Tests: Minimum 200 psi and in accordance with NFPA 13 for two

(2) hours.

2. Do not subject existing systems to excess pressures.

C. Alarm Tests:

1. Demonstrate activation of alarms and operational trip test.

3.4 SYSTEM TURNOVER

A. Prior to final acceptance, instruct the Owner's Representative in the proper operation, maintenance, testing, inspection and emergency procedures for all systems furnished, for a period of time as needed. Provide one (1) new original pamphlet of NFPA 25. Indicate in writing to the Owner's Representative the provisions for proper maintenance, testing, and inspection of the systems as required by local fire codes.

END OF SECTION

SECTION 220500 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring.

Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final steam, condensate, hot water, chilled, drain connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of **laboratory equipment** and special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent, gas, air, vacuum, lab gas connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

END OF SECTION

SECTION 220523 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

A. Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.

2. Stem packing serviceable without removing valve from line.

3. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

B. Acceptable Manufacturers:

1. Balance Valves: Armstrong and Bell & Gossett

2. Ball Valves: Apollo, Nibco, Watts.

3. Gate and Check Valves: Nibco, Watts.

4. To establish a standard of quality and identify features, certain manufacturer's numbers are given in the following paragraphs.

2.2 DOMESTIC WATER VALVES

A. Gate Valves:

1. 4 in. and Larger, Cold Water Service: Epoxy coated, resilient wedge, OS&Y, flanged ends, 175 wwp, UL/FM; Watts 408 RW.

B. Check Valves:

1. 2 in. and Smaller: Lead-free swing check with silicone bronze body, bonnet and trim, PTFE disc seat and stainless steel seat disc washer, 200 psi working pressure, Nibco T-413-Y-LF (threaded) or Nibco's S-413-Y-LF (solder).

C. Ball Valves:

1. For all water services, ball valves shall be:

a.	Body	Lead Free Bronze
b.	Body Style	Full Port, 2 piece
c.	Connection	Threaded
d.	Trim	316 Stainless Steel Ball and Stem, with stem extension to raise handle out of insulation
e.	Seat	Reinforced Teflon (RTFE), 15% glass filled double seal
f.	Seat Working P/T Rating	300 psig @ 250°F Minimum
g.	Body Working P/T Rating	300 psig @ 300°F Minimum
h.	WOG Rating	300 psig Minimum
i.	Lead free	
j.	Lever Handle	
k.	Design Basis Apollo 77CLF-140, Nibco T-585-66LF, Watts LFB6080-G2-SS	

D. Balance Valves:

1. 2 in. and Smaller: Lead-free, brass body, chrome plated brass ball, glass and carbon filled PTFE seat rings, Viton packing, threaded or solder ends, differential readout ports, calibrated nameplate and memory stop indicator rated for 125 psi; and pre-formed insulation to permit access for balancing and readout; Watt Series LFCSM-61-S.

a. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10

Balance Valve Size	GPM Range
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60

E. Pressure Reducing Valves:

1. Direct Operated for Cold Water Service:

a. Bronze body construction, renewable stainless steel seat, reinforced Buna-N diaphragm and valve disc integral strainer, adjustable reduced pressure range, for dead end service.

b. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

2. Direct Operated for Hot Water Service:

a. Water Wash Hoods: Same as cold water except with built-in by-pass option; outlet set at 40 psi, rated at 160°F.

b. Dishwashers: Same as cold water except with low pressure range and built-in by-pass option; outlet set at 22 psi, rated at 200°F.

c. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

F. Valves for Gauges and Instruments:

1. Use Ball Valve

G. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #LFFBV/FBVS-3C-CC.

2.3 NON-POTABLE, COMPRESED AIR, VACUUM SYSTEMS VALVES

A. For non-potable and house compressed air, and vacuum, ball valves shall be:

a. Body — Bronze

b. Body Style — Full or Standard Port, 2 piece

c. Connection — Threaded

d. Trim — 316 Stainless Steel Ball and Stem

e. Seat — PTFE or TFE

f.	Seat Working P/T Rating	300 psig @ 250°F Minimum
g.	SWP Rating	150 psig Minimum
h.	WOG Rating	300 psig Minimum
i.	Lever Handle	
j.	Design Basis Apollo 77LF-140 HC, Nibco T-580-66LF	

2.4 HIGH PURITY WATER SYSTEM VALVES

A. Diaphragm Valves

1. 1/2 in. to 2 in: rated for 150 psi, manually operated, lockable handle, socket union ends, EPDM diaphragm; design basis: Georg Fischer 519 zero static

2. Materials of construction for valves shall match the piping materials in which valve is installed.

B. Pressure Regulator Valve

1. Polypropylene, NPT connections, one piece body housing containing the inlet port, outlet port, valve seat, and pressure sensing orifice. Regulator shall have a piston with a fabric reinforced EPDM rolling diaphragm sensing the downstream pressure and providing for maximum sensitivity and control accuracy.
The shaft connecting the piston and the valve seat seal assembly shall have a double u-cup seal for safety. All units shall be 100% individually tested at the factory.

2. Design Equipment: Plast-O-Matic Valves #PRHM050EP-PP

C. Flow Meter

1. Rotometer ; design basis: Georg Fischer type 507

2. Materials of construction for valves shall match the piping materials in which valve is installed.

D. Pressure Gauge

1. With reducing tee matching piping material, no direct contact from pressure gauge to pure water, large surface diaphragm, design basis, Goerg Fisher Z500/501

2. Materials of construction for valves shall match the piping materials in which valve is installed.

2.5 GAS VALVES

A. Ball Valves:

1. For natural gas, ball valves shall be:

a.	Body	Bronze
b.	Body Style	Full or Standard Port, 2 piece
c.	Trim Brass Stem	chrome plated brass ball, ASTM B16
d.	Seat	PTFE
e.	SWP Rating	150 psig Minimum
f.	WOG Rating	600 psig Minimum
g.	Lever Handle	
h.	Design Basis Apollo 77G-UL, Watts B6000-UL	

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all shutoff, check, balancing and other type valves as indicated, as required by Code and as required for proper system maintenance, isolation and safety. Provide at major building and systems sections. Provide shutoff valves on all branch lines serving two fixtures or more, at all equipment, fixtures, before and after automatic control valves, and at future connections.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide drain valves with hose thread connections on all equipment. Provide hose thread drain valves at all low points to enable complete drainage of all piping systems including, water mains, branches, at base of vertical risers and at strainers.

D. Provide shutoff valve and wye-strainer before all automatic control valves and pressure reducing valves.

E. Inspect valves for proper operation before installation. Install underground valve boxes vertically over each valve. Adjust top of box to proper grade. Immediately backfill with crushed stone and carefully tamp into place. Unless otherwise noted, leave in the open position.

3.2 DOMESTIC WATER SYSTEM

A. The main water service shutoff valve inside the building and valves for a 3 in. and larger water meter assembly shall be OS&Y gate valves in accordance with the local water authority requirements.

B. Install balance valves in each hot water circulation branch and where noted.

3.3 NATURAL GAS SYSTEM

A. Ball valves shall be UL listed for use in natural gas systems, or certified by another acceptable third-party testing agency.

END OF SECTION

SECTION 220580 - EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment, and services to perform operations required for the complete installation and related work as required in the Contract Documents.

1.2 SUBMITTALS

A. Not required.

1.3 CODES

A. Comply with local, state, and federal codes, regulations, and laws affecting work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cushion Sand: Clean, coarse, and free of organic matter, conforming to New York State DOT Item No. 703.06.

B. Crushed Stone: Crushed stone, graded, free of organic materials, No. 1 to No. 4 size. Conforming to New York State DOT Item No. 703-0201.

C. Gravel Fill: Well-graded natural inorganic sand and gravel conforming to New York State DOT Item No. 703-0202.

D. Ordinary Fill: Well-graded, natural soil, meeting the following requirements:

1. Free of organic and other compressible materials, debris and frozen materials, and of stones larger than 4 in. maximum dimension.

2. Be of such nature and character that it can be compacted to the specified densities.

3. Free of highly plastic clays, of materials subject to decay, decomposition, or dissolution, and of cinders, ash and other corrosive materials.

4. Maximum dry density of not less than 115 lbs. per cu. ft.

5. Material from excavation on the site may be used as ordinary fill if it meets the above requirements.

PART 3 - EXECUTION

3.1 PREPARATORY WORK, SCHEDULING SHUTDOWNS, AND TEMPORARY WORK

A. Build lines to grade and elevations shown. Provide stakes, grade boards, cleats, nails, and instruments. Locate and stake each new run for its entire length. Verify elevations given. Start excavation at low point. Notify Engineer of elevation discrepancies. Protect marks and stations. Before starting excavation work, coordinate with and furnish schedule of work to Owner's Representative and other trades. Provide and maintain temporary walks and bridges over excavations where underground utility lines, sewers, water lines, etc., cross access roads, walks, and streets. Make necessary arrangement with authorities having jurisdiction.

3.2 PROTECTION

A. Provide bracing, shoring, sheathing and other work for protection of personnel, the contract work, excavations, trees, shrubs, existing structures, and surrounding properties. Provide and maintain barricades, warning signs, flags, and lights for the protection of work, workmen, public, and property. Plank walks, pavements, and curbs to be crossed by equipment. Protect adjacent property, fences, trees, shrubs, roads, curbs, sidewalks, manholes, hydrants, and other items.

1. Restore, repair or replace any items damaged or destroyed to a condition equal to that existing before such damage occurred.

B. The use of equipment with metal tracks over paved areas is not permitted unless the pavement is protected with methods as approved by the Owner's Representative.

3.3 INVESTIGATION AND PROTECTION OF EXISTING UTILITIES

A. Every attempt has been made to indicate existing utilities as accurately as possible from existing drawings, surveys, and data. Immediately report other utility lines encountered, but not shown on the drawings. Notify Underground Facilities Protection Organization (UFPO) before starting work. Phone (800)-962-7962 for information and location of nearest organization address and telephone number. Verify exact location of existing utility lines where work crosses existing utilities and where connections are to be made by test hole before starting work. Notify utility companies, municipalities, and other involved jurisdictions when excavating occurs within vicinity of existing underground service such as sewers, water, electric, gas, telephone, including such services owned by Owner. If existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during this excavation, they shall be protected from damage, and securely supported as directed and approved by the involved jurisdiction. Comply with all local, state and federal regulations when working in vicinity of combustible gas piping. Immediately report damage to utility lines to Owner's Representative and involved jurisdiction. Repair or replace utility lines damaged or destroyed as directed and approved by the involved jurisdiction. Excavate by hand in proximity to existing underground utility lines; take extreme care when excavating around ductbanks carrying energized cable. Remove, plug or cap inactive or abandoned utilities encountered during construction operations.

The location of such utilities shall be noted on the record drawings. Verify inactivity of services with involved jurisdiction before start of work.

B. Saw cut floor slabs perpendicular to surface and parallel with/perpendicular to walls. Replace slabs and adjacent surfaces damaged by excavation operations with materials equal to adjacent existing materials.

3.4 CUTTING AND PATCHING

A. Prior to starting work, obtain necessary permits and pay all costs and fees. Cut paved areas, perpendicular to surface and in straight saw-cut lines. Replace pavements, roadways, streets, blacktop areas and walks damaged by excavating operations with materials equal to adjacent pavements.

3.5 EXCAVATION

A. Provide for buried work in contract both inside and outside of building. Excavate to proper depth and width for installation work and comply with rules set forth by New York State Department of Labor. Remove materials including masonry work, rubble, earth, brickwork, concrete, sand, debris, abandoned pipe lines, drains, sewers, rocks, boulders, and concrete, all of which is considered "earth excavation". Provide for legal disposition of excess excavated materials. Make allowance for gravel fill, sand bases, form work, floor slabs, manholes, anchor and thrust blocks, sheet piling, drainage pumps, and work space. Start excavation at rough grade and provide form work and sheet piling where required.

B. Trench Excavation:

1. By open cut, to proper depth and grade no wider than required for placement of work and not more than 100 ft. in advance of utility being installed.

2. Should trench bottom be wet, unstable or otherwise incapable of supporting the contract work, immediately report the condition to the Owner's Representative. Should it be deemed unsuitable, excavate to depth as directed and backfill with gravel to trench depth, or provide concrete cradling.

3. Should rock be encountered, excavate 6 in. deeper and fill space between trench bottom and pipe with coarse sand, well compacted to form a firm pipe bed.

C. Shoring, Bracing, Sheathing:

1. In addition to governing codes, protect sides of excavations with shoring, bracing and sheathing to prevent sliding or caving of banks and to protect adjacent structures. Remove as backfill is placed.

2. Provide at locations adjacent to existing manholes, hydrants, and similar items.

D. General Excavation:

1. As required for all buried work. This shall include, but not be limited to, piping, tanks, ductbanks, conduits, footings, manholes, anchors, concrete pads, thrust blocks, fixture bases, and other work in contract.

3.6 BACKFILL

A. Bedding:

1. Around piping with cushion sand from 6 in. below to 8 in. above. Apply by hand and compact under and at sides by mechanical means.

2. Piping, jackets and sand bed must be inspected and tested prior to backfill of any nature. Provide necessary anchors, thrust blocks, for testing.

B. Remainder of Trench:

1. Backfill remainder of trench in 12 in. layers, with ordinary fill materials, except as otherwise specified. Do not use frozen material. Remove boulders, stones, broken rock, wood, bricks, blocks, and debris from fill materials before backfill operation.

C. Compaction Requirements:

1. Compaction to not less than 95% density compared to maximum laboratory tests by weight, per modified ASTM D1557-64T, latest editions, Method "A" under slab on grade, roadways, drives, and other paved areas and 85% for general grading. Submit certified test results by an approved soil testing laboratory.

3.7 REMOVAL OF WATER

A. Provide pumps, hoses, pipe, labor and fuel, necessary to keep excavations free of water accumulation. Maintain and operate equipment. Discharge water in manner not to interfere with any trade's work, undermine or disturb adjacent structures or properties. Grade to prevent surface water from flowing into all excavations and trenches. Do not discharge dirt, backfill or debris into sanitary or storm drainage systems.

3.8 ROUGH GRADING

A. Trim and grade areas to receive fill material or topsoil specified.

B. Set grade stakes where spot elevations are shown, at breaks in grade, along drainage "swales" and as otherwise required to correctly grade the area to existing conditions.

C. On completion of rough grading, obtain Owner's Representative's approval before spreading topsoil or preparing pavement subgrade.

D. Compact fill as specified.

3.9 REPAVING

A. Replace pavement and subbase materials for roads, streets, parking areas, walks, and other surfaces that were damaged or removed during construction. Use details shown on drawings and follow the New York State Department of Transportation item numbers given for base, binder and top courses of bituminous pavement.

3.10 RESTORATION

A. On completion of the work, clean the entire site, remove surplus earth, large stones and debris and legally dispose to an off-site location. Remove tools and equipment and leave the entire area in a neat condition.

END OF SECTION

SECTION 220593 - ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide information in report form listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.

B. Report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

1.3 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Individual manufacturer requirements and recommendations.

B. Maintain qualified person at project for system operation, trouble shooting and perform mechanical adjustments in conjunction with balancing procedure.

C. Balancing contractor shall be current member of AABC or NEBB.

1.4 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balancing facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.

2. Prior to balancing adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required. Instruments used shall be accurately calibrated as per AABC or NEBB requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine Bid Documents and notify Owner's Representative of any questions regarding balancing, within thirty (30) days after receipt of bid and prior to starting work.

3.2 WATER SIDE

A. Test, adjust and record the following:

1. Hot Water Recirculating Pump:

    a. Check rotation
    b. GPM
    c. Running suction pressure
    d. Running discharge pressure
    e. Running load amps
    f. RPM - motor
    g. Complete nameplate motor and pump

2. Recirculation Balancing Valves:

    a. Balance every valve to 1.0 GPM, unless otherwise noted.

END OF SECTION

SECTION 220700 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

A. Shall include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.

2. Insulation, including jackets, finishes and adhesives on the exterior surfaces of pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

3. Asbestos or asbestos bearing materials are prohibited.

4. 2020 Energy Conservation Code of New York State.

5. All adhesives and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ E4.1 and EQ E4.2.

6. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.

7. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.2 ACCEPTABLE MANUFACTURERS

A. Fiberglass: Knauf, Johns Manville, Owen-Corning, Certainteed

B. Adhesives: Childers Products, Foster.

2.3 PIPE INSULATION (RIGID FIBERGLASS TYPE)

A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F.

C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system shall consist of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures shall be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.4 FIRE RATED INSULATION

A. Wrap shall be fully tested against external fires (ASTM E 119/UL263), through penetration insulated piping fires (ASTM 814/UL1479), wall fires (ASTM E 119), and surface burning (ASTM E 84/UL723). Wrap for engine exhaust applications shall use two layers of 1-1/2 in. wrap. The interior layer shall be applied with a butt joint. The second layer shall be offset a minimum of six inches from the initial layer, with an overlap of three inches and the insulated pipe is banded with stainless steel straps.

B. Acceptable Manufacturers: John Mansville Firetemp Wrap, Certainteed FlameChek or approved equal.

2.5 FIELD-APPLIED JACKETS

A. Piping:

1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; 25 or less flame spread rating/50 or less smoke developed rating, roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.

2.6 COATINGS, MASTICS, ADHESIVES AND SEALANTS

A. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.

B. Foster 95-50; Childers CP-76, or approved equal.

2.7 PIPE SUPPORT INSULATION INSERTS

A. 20 lbs./cu. ft. molded fiberglass, for -120°F to +450°F service temperature, non-combustible, 0.30 thermal conductivity (k), same thickness as pipe insulation.

B. Acceptable Manufacturers: Hamfab "H" Block, or approved equal.

2.8 MATERIALS AND SCHEDULES

A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.

C. All pipe insulation shall be continuous through hangers, sleeves, walls, ceiling, floor, or roof openings, unless not allowed by fire stop system. Refer to Sections 220500, "Basic Plumbing Requirements" and 221010, "Piping Systems and Accessories" for firestop systems.

D. Provide thermal insulation on clean, dry surfaces and after piping and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, drain valves, etc. must be totally encapsulated with Elastomeric insulation.

F. Items such as manholes, handholds, clean-outs, plugged connections, pet cocks, air vents, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem.

When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personal injury.

H. All pipes shall be individually insulated.

I. If any insulation material becomes wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

J. All exposed surfaces shall be white, unless noted otherwise.

3.2 PIPE INSULATION

A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed.

B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed. Insulation shall be continuous through hangers on all water piping and storm water piping.

C. Hanger Shields: Refer to Section 221010 "Piping Systems and Accessories".

D. Hanger shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.

2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.

3. Tape shields to insulation.

E. Joints in section pipe covering made as follows:

1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.

2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.

3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating.

F. Fittings, Valves and Flanges:

1. Domestic Hot and Cold Water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation.

2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.

G. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

H. Apply PVC jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases.

I. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness called for. Piping in wall chases: In addition to the above, pack chase with loose glass fiber insulation.

J. Provide insulation on exposed hot and cold plumbing piping to within 18 in. of fixture or equipment connection.

K. Insulate exposed domestic water and waste piping for plumbing fixtures designated for use by the handicapped.

EXHIBIT "I" - PIPE INSULATION MATERIALS
(Notes at end of Exhibit "I")

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Domestic cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTES 1
Non potable cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTE 2
Domestic hot, tempered and circulation water (105°F - 140°F)	Glass fiber	1-1/2 in. and larger: 1-1/2 in. 1-1/4 in. and smaller: 1 in.	SEE NOTES 1
Domestic hot, tempered and circulation water (141°F - 200°F)	Glass fiber	1-1/2 in. and larger: 2 in. 1-1/4 in. and smaller: 1-1/2 in.	SEE NOTES 1
AC unit drains, overflows and indirect waste piping associated with any HVAC equipment	Glass fiber	All sizes: 1/2 in.	Not required for exposed PVC drains
Storm and secondary storm water	Glass fiber	All sizes: 1 in.	Insulate body of drain and storm water piping, horizontal and vertical, down to connection below ground floor slab or in crawl space

NOTES FOR EXHIBIT I:

NOTE 1: Exposed insulation at kitchen, laundry, and sterilizer equipment shall be covered with PVC jacket.

END OF SECTION

SECTION 221010 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All items here-in used to convey water for potable use shall be lead free in accordance with NSF, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

C. All adhesives, sealers and primers used for piping in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ4.1 and EQ4.2.

2.2 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

2.3 COPPER TUBE AND FITTINGS

A. Pipe: ASTM B88; Type K or L, hard temper. Soft temper only as called for. Plans show copper tube sizes.

B. Fittings: Wrought copper and copper alloy, ASME B16.22 or cast copper alloy, ASME B16.18; solder end connections.

C. Joints: Comply with the requirements of ASTM B828.

D. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

E. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

F. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.

G. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.4 COPPER DRAINAGE TUBE AND FITTINGS

A. Pipe: ASTM B306, Type DWV, hard temper.

1. Copper not allowed for urinal waste.

B. Fittings: Wrought copper, ANSI B16.29 or cast bronze, ANSI B16.23; solder end connections.

C. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

D. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.

E. Acceptable Manufacturers: Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe", or approved equal.

2.5 HIGH PURITY POLYPROPYLENE PIPING AND FITTINGS

A. Piping: Schedule 80 / SDR 11 polypropylene produced without additives or pigments. Piping shall be sterilized and capped by manufacturer.

B. Fittings: Same material as pipe, sterilized and packed in individual bags by manufacturer, socket fusion weld joints.

C. Valves: Material shall be identical to pipe, socket fusion weld joints.

D. Acceptable Manufacturers: Georg Fischer PROGEF, Asahi/America PP-Pure

2.6 NO-HUB CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A888, CISPI Standard 301, no-hub cast iron, bitumen coated.

1. For above grade only.

B. Fittings: Cast iron, no-hub drainage pattern, bitumen coated.

C. Couplings:

1. 1-1/2 in. to 2 in.: CISPI standard 310 with 300 series stainless steel corrugated shield and clamp assembly with ASTM C564 neoprene sealing sleeve (or) same as specified for 3 in. and larger.

2. 3 in. and Larger: 24 gauge, Type 304 stainless steel housing clamp assembly with ASTM C564 neoprene sealing sleeve, 60 in. lbs. minimum torque rating, shall meet requirements of pipe manufacturer and shall be compatible with specified pipe. Acceptable Manufacturers: Clamp-All Coupling System, Tyler "Wide Body", Husky "Series 2000", Mission "Heavy Weight" or approved equal.

D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.7 ACID RESISTANT WASTE PIPING AND FITTINGS

A. Polypropylene:

1. Pipe and Fittings: Schedule 40 flame retardant polypropylene, ASTM D4101.

2. Fittings shall be same material as pipe with thermal welded joints.

a. For accessible 1-1/2 in. and 2 in. piping below counters, sinks and equipment, provide mechanical joint or thermal welded unions at traps to permit disassembly.

b. Piping through wall or floor at roughing point for sinks and equipment shall be provided with male IPS threaded adapter.

3. Acceptable Manufacturers: IPEX "Enfield", Orion Fitting, Inc., R&G Sloane.

2.8 SPECIAL FITTINGS

A. Cast Iron to Lead Pipe: Red brass ferrules and wiped joints. Caulk ferrule into cast iron hub.

B. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.

C. Copper to Steel Piping:

1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.

2. Dielectric pipefittings.

D. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

E. No-Hub, Cast Iron, Glass, Polypropylene or High Silicon Cast Iron: Proper adapter to piping being connected.

F. Cast Iron and PVC Solvent: Aerators and deaerators as manufactured by Conine Manufacturing Co., Inc.

2.9 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Nipples: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Watts or approved equal.

E. Dielectric unions are not acceptable.

2.10 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Adjustable steel clevis type for piping 4 in. and larger.

4. Nuts, washers and rods with electroplated zinc or cadmium finish.

5. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.

C. Spacing Schedule:

Pipe Size	Steel	Copper	Plastic	Cast Iron	Rod Size
3/4 in. to 1 in.	8 ft.	6 ft.	3 ft.	Each	3/8 in.
1-1/4 in. to 2 in.	10 ft.	6 ft.	3 ft.	Horizontal	3/8 in.
2-1/2 in. to 4 in.	12 ft.	10 ft.	4 ft.	Joint 5 ft.	1/2 in.
5 in. and over	12 ft.	10 ft.	4 ft.	Maximum	5/8 in.
8 in.	12 ft.	10 ft.	4 ft.	O.C.	3/4 in.
Over 8 in.	To suit loading conditions.				

D. Cast Iron No-Hub Supports:

1. In accordance with manufacturer's recommendations.

2. Vertical piping supported at each stack base, at each floor and 15 ft. on center, maximum. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment. Bases of stacks shall be supported on concrete, brick laid in cement mortar, metal brackets attached to the building construction or by other methods approved by the Owner's Representative.

3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.

E. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

F. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.

4. For Wood Construction: Provide hangers and supports designed for attachment to wood construction.

5. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

H. Trapeze Hangers:

1. For plumbing systems only.

2. Hangers shall be supported with rod sized with a safety factor of four.

3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.

4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.

5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.

I. Cabinet Pipe Space Supports:

1. Piping below casework countertops within space behind cabinet shall be supported using continuous slot metal channels with pipe clamps.

2. Acceptable Manufacturers: B-Line, Kindorf, Unistrut or approved equal.

J. Hanger Insulation Shields:

1. Hanger insulation shields shall be provided for all water and storm water piping. Hangers shall attach directly to pipe for all remaining services.

2. Piping 2 in. and Smaller: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation.

3. Piping 3 in. and Larger: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield and pipe support insulation insert(s) between pipe and hanger. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation. Provide temporary blocking to maintain proper spacing for insulation.

K. Provide continuous support for unpigmented polypropylene piping.

L. Piping systems with material not listed above shall be supported and protected in accordance with manufacturer's recommendations.

2.11 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.

B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.

2.12 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

2.13 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.14 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.15 STACK SLEEVE

A. Cast iron body with caulking recess, flashing clamp and under deck clamp.

B. Acceptable Manufacturers: Jay R. Smith Series 1720, Zurn, Wade.

2.16 STRAINERS

A. Description: Y-Pattern, self-cleaning, except where otherwise indicated, full size of connecting piping, Type 304 stainless steel screens, 125 lb. SWP, unless otherwise indicated.

B. Copper Piping 2-1/2 in. and Smaller: Lead free, cast bronze body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #LF777S.

C. Piping 3 in. and Larger, Cold Water Applications: Lead free, cast iron body, flanged ends, standard screen openings, FDA approved epoxy coating, tapped retainer cap and gasket with closure plug; Watts #77F-DI-FDA-125.

2.17 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.

B. See Exhibit "B", "Testing" at end of this Section.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations.

Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger that 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.

B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.4 PIPE CONNECTIONS

A. No-Lead Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.

C. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

D. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Dielectric Pipe Fittings: Provide dielectric nipples at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined.

1. Dielectric Unions are not be to used.

3.5 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.

B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.

C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.

D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.

E. Fill abandoned sleeves with concrete.

F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.6 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior Locations: Firmly pack with fiberglass and caulk.

2. Exterior Walls and Below Grade Cored Holes: Use sealing element.

3. Cored Holes: Use sealing element.

4. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

5. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

3.7 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.8 TESTS

A. Refer to Exhibit "B" at the end of this section for testing of Plumbing Systems.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

C. Domestic Water:

1. Do not cover joints with insulation until required tests are completed and the Owner's Representative accepts the system.

2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.

3. Air test not acceptable as final test.

4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

D. Sanitary and Storm:

1. There shall be no loss of water when testing interior piping.

2. Air test not acceptable as final test.

3. Should any leaks, defective joints or defective construction be detected in sewers and/or floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.

4. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

3.9 DOMESTIC WATER PIPING CLEANING AND DISINFECTION

A. Cleaning and disinfecting shall be in accordance with requirements of New York State Department of Health and authority having jurisdiction. Prior to disinfecting, flush piping to remove any sediment and debris.

B. Clean and disinfect water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired.

C. After disinfection procedures, submit water samples in sterile bottles to an approved Department of Health Laboratory. Samples shall be proven equal to the water quality served to the public from the existing water supply system and acceptable to the Department of Health. Flush and disinfect all sections of pipe that fail the laboratory tests. Submit test results indicating water is potable.

3.10 CONNECTIONS TO SPECIAL EQUIPMENT

A. Laboratory or Other Equipment:

3.11 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Water and Fire service	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Domestic water interior/hot, cold and circulating 3 in. and smaller	Type L copper	Wrought or cast copper	No-lead solder
Sanitary, sanitary vent, grease waste and storm (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sanitary, sanitary vent and grease waste	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Type DWV copper	Wrought copper	No-lead solder (SEE NOTE 3)
Storm	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Type DWV copper	Wrought copper	No-lead solder
Indirect waste 1” and Smaller	Type M copper	Wrought copper	No-lead solder
Indirect waste 1 ¼” and larger	Type DWV copper	Wrought copper	No-lead solder
Lab waste and vent	Polypropylene	Polypropylene	Thermal fused (joint) including concealed locations, mechanical joint below counters, sink and equipment only
Natural gas (exterior above grade)	Schedule 40, black steel	Butt welded steel	Welded (SEE NOTE 2)
	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Natural gas (interior)	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
	Schedule 40, black steel	Butt welded steel, 2-1/2 in. and larger	Welded (SEE NOTE 2)
Pure Water (Supply and Return)	Schedule 80, unpigmented polypropylene	Same as pipe	Thermal fused
Compressed air-house (doors, lab equipment, etc.)	Type L copper	Wrought copper	Brazed
Vacuum	Type L copper	Wrought copper	Soldered

NOTES FOR EXHIBIT A:

NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code. Pipe and fittings shall be flanged.

NOTE 2: Provide one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel on exposed exterior and interior piping. Color as selected.

NOTE 3: Copper piping shall not be used for urinal waste piping.

NOTE 4: All uninsulated piping supported by trapeze hangers shall be securely fastened to each hanger using strut-mounted cushion clamps.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Domestic water	Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.
Indirect waste	Maintain 10 ft. head of water for two (2) hours.
Lab waste and vent	Maintain 10 ft. head of water for two (2) hours.
Pump discharge	Hydrostatically test at 5 PSI greater than the pump rating for two (2) hours.
Natural gas	Refer to Section 227010 - "Natural Gas Systems".
Pure Water	Test with inert gas (nitrogen) at a pressure of 125 PSI for two (2) hours.
Compressed air and Vacuum (house)	Test with clean air or nitrogen at a pressure of 175 PSI for 24 hours.

END OF SECTION

SECTION 221011 – SPECIALITY GAS PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Product data: Provide data on tube materials, tube fittings, valves, and accessories. Provide manufacturer's catalogue information. Indicate model number, technical data, ratings, final cleaning, testing, and quality assurance procedures.

1. Identify all exceptions to the applicable requirements of the specifications and procedures and submit for approval.

B. Complete set of as-built drawings showing actual field conditions, incorporating any field changes, including flow diagrams by system, and plan view drawings.

C. System Section Turnover: At installation completion of system sections such as mains and laterals, submit for turnover so that conformance review and certification testing can proceed.
Send as-built drawings with submittal as described in the preceding section.

D. Visual reference samples of all materials requiring special surface treatment are to be submitted prior to material processing. Upon acceptance, the samples become a reference by which to compare subsequent visual inspection.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with a minimum 3 years' documented experience.

B. Manufacturer of Valves: Company specializing in manufacturing valves for electronics industry with a minimum of 3 years' documented experience.

C. Installer: Company specializing in performing the work of this section with a minimum 5 years' documented experience, the latest being within the last 12 month period.

D. Tubing Testing and Certification: Company specializing in testing and certifying piping systems with a minimum 5 years' documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. For specialty gas systems, handle, store, and protect as follows:

1. Store all products in a sheltered location in such a manner to prevent damage and/or contamination.

2. Store tubing and fittings separately by types.

3. Clean and inspect all products in an ISO 5 (ISO 14644-1) cleanroom prior to installation. Personnel in the cleanroom must wear appropriate cleanroom garments, like booties, smocks, gloves, and caps. Change garments and gloves as they become soiled; change booties each time the cleanroom is re-entered from a less clean environment. Maintain the cleanroom in an orderly fashion. Cleanroom to be certified to IES recommended practices and International Standards ISO 14644, latest revision.

4. For stainless steel valves, handle, store, and protect as follows:

a. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

b. Maintain high purity packaging intact.

1.5 GUARANTEE

A. Supplier shall provide warranty on all parts and labor for one year beginning at the receipt of goods. Supplier warrants that all products provided under this specification will be free from defects in material and workmanship under normal use and service. Spares parts are subject to part manufacturer's warranty.

1.6 COORDINATION

A. Coordinate work in accordance with direction of Owner.

B. Notify Owner of all conflicts.

C. Coordinate equipment fit up when using shop-fabricated tubing. Make adjustments due to inaccuracies of equipment installation and to location of existing obstructions.

D. Schedule all tie-ins with the Owner with two week notice.

E. Provide fittings to match mating fittings of equipment instruments and tubing.

F. Provide valves per drawings and schematics.

G. Provide valves of same NPS as tube connection found on schematic unless otherwise noted. If NPS changes at valve, provide to meet smaller NPS.

H. Before the start of work, examine the project site and all drawings to become familiar with existing conditions. Coordinate with the work of other trades so as to avoid installation conflicts.

I. Verify all indicated elevations, dimensions, and locations before proceeding with the work.

J. Notify the Owner in writing of any conflicts, errors, or discrepancies between the drawings, specifications, or procedures.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.2 STAINLESS STEEL TUBING AND FITTINGS

A. Standard Instrument Tubing

1. Seamless 316L Stainless Steel tubing and Fittings

2. Chemical Composition by weight %

   a. Chromium 16.0 to 18.0

   b. Nickle 11.0 to 14.0

   c. Molybdenum 2.0 to 3.0

   d. Manganese 2.0 Max

   e. Carbon .035 Max

   f. Sulfur .030 Max

3. Meeting ASTM A213 / A269

4. Finished tubes shall have ends free of burrs and inside surface shall be free of dirt, chips, oil scale or corrosion.

5. All components of this system shall meet the standard for Swagelok SC-10 cleaning for components.

Size	Thickness
1/4-inch through 3/8-inch OD tube	0.035-inch (+ 10%)
1/2-inch OD tube	0.049-inch (+ 10%)

3/4-inch OD tube	0.065-inch (+ 10%)

6. Acceptable Manufacturers: Swagelok, Cardinal Systems, Inc, Dockweiler

2.3 FITTINGS

A. Tube Fittings: Live-loaded, two-ferule design, easy to install, no torque to tubing during installation.

B. Acceptable manufacturer; Swagelok

2.4 VALVES

A. Ball Valves:

1. Body: 316 SS / A276 and A479

a. Integral Swagelok Tube Fitting ends: 316 SS / A276

2. Directional handle

3. Manufacturers: Ball Valve, 1/4-Inch Through 1/2-Inch:

a. Swagelok 40 and 40G Series

4. Manufacturers: Ball Valve, 1/2-Inch Through 1-Inch:

a. Swagelok 60 Series

2.5 REGULATORS

A. Refer to plans for schedules.

2.6 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Nuts, washers and rods with electroplated zinc or cadmium finish.

4. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.

C. Spacing Schedule:

Pipe Size	Steel	Rod Size
1/4 in. to 1 in.	7 ft.	3/8 in.
1-1/4 in. to 2 in.	7 ft.	3/8 in.

D. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.

F. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.

4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

G. Trapeze Hangers:

1. For plumbing systems only.

2. Hangers shall be supported with rod sized with a safety factor of four.

3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.

4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.

5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.

2.7 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.

B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.

2.8 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

2.9 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.10 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.

B. See Exhibit "B", "Testing" at end of this Section.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point.

Only concentric type hangers are permissible on piping larger that 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.

B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.4 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.

B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.

C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.

D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.

E. Fill abandoned sleeves with concrete.

F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.5 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior Locations: Firmly pack with fiberglass and caulk.

2. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

3. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

3.6 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.7 INSTALLATION –STAINLESS STEEL TUBING

A. Certify personnel in accordance with corresponding procedures section.

B. Certify facilities in accordance with these specifications and corresponding procedures section.

C. Specific task execution shall be in strict accordance with corresponding procedures.

D. Maintain all tools in a clean condition. Segregate tools for stainless steel and keep separate from carbon steel and copper system installation tools. Handle tubing and fittings with clean gloves at all times.

E. Run lines as direct as possible from nearest terminal valve. Provide accessibility to valves. Stagger valve spacing to allow for valve operation and for lockout/tagout devices.

F. Support lines and fittings, keeping axis straight and in alignment.

G. If the system is contaminated due to fabrication technique, replace the system at no expense to the Owner. Make no attempt to re-clean contaminated material in the field.

H. Install lines without springing, forcing, or placing in due stress on the tube, fittings, connected equipment, or terminals. Do not contact tube with the structure, except where shown.

I. Field installed tubing only: Minimize use of fittings for 1/4-inch through 1/2-inch stainless tubing by using tube bends. Bend tubing at a minimum radius of 10 times the nominal tube diameter. Where physical constraints prevent 10 diameter radius or the tube is larger than 1/2-inch, use pre-made fittings and welded joints. Make all bends free of flat spots and corrugations. No continuous bends more than 90 degrees shall be permitted.

3.8 INSTALLATION – ULTRA-HIGH PURITY STAINLESS STEEL VALVES

A. Install in accordance with manufacturer’s instructions.

B. Provide clearance for installation of insulation where required and access to valves.

C. Provide access where valves are not exposed.

D. Install valves with stems positioned for easy access.

E. Use only clean, dry, non-lubricated valves that have not been cleaned in any fluorocarbon product.

F. Use only pre-cleaned valves received in sealed inert gas filled bags.

G. If a bag seal is broken, reject valve to manufacturer. Make no attempt to re-clean contaminated components.

3.9 TESTING – GENERAL

A. Submit testing procedure reports

B. Conduct tests prior to applying insulation.

C. Examine for leakage at joints and connections. Correct visible leakage.

D. Replace damaged gaskets and bolting.

E. Install new gaskets each time a mechanical joint is made.

F. Record test results. Include the following data on test reports.

1. Date of test.

2. Description and identification of tubing tested.

3. Test fluid.

4. Test pressure.

5. Test duration.

6. Remarks to include:

a. Leaks (type, location).

b. Repairs made.

7. Date and signature of witness.

G. Replace defective materials and correct any problems with workmanship at no cost to Owner. Conduct testing until system is satisfactory.

H. Repair defective welded joints by removing and replacing with a sound weld of the proper section. Additional welding over defects is not allowed. Cost of repairs due to poor workmanship shall be borne by the installing contractor.

I. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 TESTING – PRESSURIZATION TESTING

A. Use liquid source Argon, filtered through dual 0.05 micron or better filters, at purity levels as defined in these specifications.

B. Pressurize to test pressure of 250 psig for a 4-hour minimum time period. Record gauge pressure and ambient temperature at start and end of test period. The final pressure must be corrected for any temperature changes that occurred between the initial pressurization and the end of the test period.

C. All pressure gauges on the system shall be removed and ports capped with VCR caps prior to testing to prevent damage to gauges. System shall be pressure tested up to the tool connection point, capped but not connected to the tool.

D. System pressure shall be monitored using a 4-1/2 inch dial face gauge with knife- edged pointer, with maximum of 2 psig divisions, accuracy of 0.25% of span, and full scale

E. Acceptance criteria is that no pressure decay (0%) compensated for temperature, may be detected. Any confirmed decrease shall require repair and re-testing of the system.

3.11 CONNECTIONS TO SPECIAL EQUIPMENT

A. Laboratory or Other Equipment:

3.12 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)

(Notes at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS/VALVES	NOTES
Nitrogen (N2)	Standard Instrument Tubing	Tube Fitting / ball valve	(SEE NOTE 1)
Carbon Dioxide (CO2)	Standard Instrument Tubing	Tube Fitting / ball valve	(SEE NOTE 1)

NOTES FOR EXHIBIT A:

NOTE 1: Follow Pressurization Testing

END OF SECTION

SECTION 221020 - UNDERGROUND PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents

1.2 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings new and marked with manufacturer's name, complying with applicable ASTM and ANSI Standards.

2.2 CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A74 service weight cast iron, bitumen coated, hub and spigot.

B. Fittings: Service weight cast iron, bitumen coated, hub and spigot, ASTM C564 service weight neoprene gasket of same manufacturer as piping.

C. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.3 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.

B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.4 ACID RESISTANT WASTE PIPING AND FITTINGS

A. Polypropylene:

1. Pipe and Fittings: Schedule 80 flame retardant polypropylene, ASTM D4101.

2. Fittings shall be same material as pipe with thermal welded joints.

a. Piping through floor at roughing point for sinks and equipment shall be provided with male IPS threaded adapter.

3. Acceptable Manufacturers: IPEX "Enfield", Orion Fitting, Inc., R&G Sloane.

2.5 DETECTABLE TAPE

A. Detectable underground warning tape, 5 mil. polyethylene, 6 in. wide, aluminum backing, APWA approved background colors within permanent black lettering identifying service below.

B. Schedule:

1. Sanitary: Green color, "Caution Buried Sewer Line Below".

2. Storm: Green color, "Caution Buried Sewer Line Below".

3. Water: Blue color, "Caution Buried Water Line Below".

4. Electric: Red color, "Caution Buried Electric Line Below".

C. Acceptable Manufacturers: Seton, Terra Tape, Pro-Line Safety Products, Inc.

2.6 SCHEDULE OF PIPING MATERIALS

A. See Exhibit "A", Schedule of Piping Materials at end of this section for piping.

PART 3 - EXECUTION

3.1 TESTING

A. Sanitary and Storm:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.

2. There shall be no loss of water when testing interior piping inside the building foundation.

3. Air test not acceptable as final test.

4. Should any leaks, defective joints or defective construction be detected in sewers, floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.

5. Test exterior piping outside the building foundation in 100 ft. sections. The allowable rate of leakage per 24 hours per in. of diameter per 1,000 ft. of sewer tested shall not exceed 25 gallons. Piping shall be inspected and tested prior to backfill.

6. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test reports to Owner's Representative.

3.2 DETECTABLE TAPE

A. Provide detectable tape directly over the buried pipe lines at a depth of 1 ft. - 0 in. below finished grade. Install tape over the continuous length of the pipe.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes are at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Sanitary and Vent	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 2)
Storm	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement
Lab Waste And Vent	Polypropylene	Polypropylene	Thermal Fused

NOTES FOR EXHIBIT A:

NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code. Pipe and fittings shall be flanged.

NOTE 2: Schedule 40 PVC pipe may not be used when the temperature of the waste can exceed 140°F.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.

END OF SECTION

SECTION 221030 - PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards and listings/approvals:

1. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.3 SUBMITTALS

A. Submit manufacturer's data in accordance with the Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this Section.

PART 2 - PRODUCTS

2.1 HOT WATER CIRCULATING PUMP

A. Pump: Inline centrifugal, canned rotor type, all stainless steel, system fluid lubricated, 175 psi working pressure, 230°F water temperature, stainless steel shaft, flange mount.

B. Motor: High efficient 4 pole synchronous, permanent magnet motor, EDPM o-ring seals to isolate stator from system fluid, non-overloading throughout the pump curve.

C. Electric Control: Pump motor shall have 3 modes: proportional pressure, constant pressure, constant curve/constant speed control. Refer to schedule on drawings for capacity and electrical characteristics.

D. Acceptable Manufacturers: Armstrong, Bell and Gossett, Grundfos.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pumps shall be installed, aligned and started in accordance with manufacturers written installation instruction.

B. Install pumps in locations to provide access for maintenance and replacement of parts.

C. Support pumps and piping separately so that piping does not support pumps.

D. Provide the services of a factory trained mechanic to start up the system based on factory recommendations. Provide Owner instruction at time of start up. Submit three (3) copies of start up report to the Owner's Representative.

3.2 HOT WATER CIRCULATING PUMP

A. Install shutoff valve and strainer on pump suction; check valve, balancing valve and shutoff valve in pump discharge. Install pressure gauge on suction and discharge piping. Adjust gpm of each circulating pump to capacity as noted.

3.3 TESTING

A. Test hot water recirculating pumps for operation.

B. Certify in writing that tests have been performed and the systems are properly operating. Submit three (3) copies of all test reports to the Owner's Representative.

END OF SECTION

SECTION 221100 - WATER SUPPLY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards, and listings/approvals:

1. ANSI/AWWA C600: AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

2. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

3. New York State Health Department.

4. Local municipality and fire department requirements and standards.

5. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.3 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this Section.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories" and Section 221020, "Underground Piping and Accessories".

2.2 WATER METER

A. Water Service: AWWA Standard Obtain meter from local Water Authority. Pay all costs. Shall meet local Water Authority Standards.

1. Acceptable Manufacturers: Mentrom-Farnier, Neptune.

2.3 BACKFLOW PREVENTERS AND ACCESSORIES

A. Reduced Pressure Type (Domestic Water - 2-1/2 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated, bronze relief valve.

2. Four (4) test cocks, epoxy-coated strainer, OS&Y resilient wedge gate valves.

3. Design Equipment: Watts Series LF009.

4. ASSE Standard 1013: AWWA Standard C511-92

5. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

B. Double Check Valve Type (Water/Fire Service - 3 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated.

2. Four (4) test cocks, OS&Y resilient wedge gate valves.

3. UL/FM listed and approved.

4. Same size as fire service.

5. Design Equipment: Watts Series LF774.

6. AWWA Standard C511-92

7. Acceptable Manufacturers: Ames Deringer, Febco, Wilkins, Watts.

C. Dual Check Type with Intermediate Atmospheric Vent (Coffee and Ice Machines):

1. Conforms to NSF Standard No. 25, stainless steel body, threaded end connections, rubber diaphragm, ball check, vent extended to drain.

2. Design Equipment: Watts 9BD.

3. Acceptable Manufacturers: Conbraco, Febco, Watts, Zurn.

D. Terminal Valve:

1. Cast iron body with flapper valve.

2. Design Equipment: Refer to drawings

3. Acceptable Manufacturers: J.R. Smith, Waterman.

2.4 VACUUM BREAKERS

A. Atmospheric Type:

1. Lead free brass body, silicone disc, ASSE 1001, threaded inlet and outlet connections, polished chrome for finished areas.

2. Design Equipment: Watts Series #LF288-A

3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

B. Hose Connection Type:

1. Brass body, stainless steel working parts, rubber diaphragm and disc, drainable, non-removable feature, polished chrome for finished areas.

2. Design Equipment: Watts #8A.

3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate work with all other trades and utility companies.

B. Inspect pipe, fittings and equipment prior to installation. Remove all defective materials from the site.

C. Do not backfill until inspection by Owner's Representative.

D. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.2 WATER SERVICE

A. Install all piping on firm bed, using caution where piping passes over excavation. Provide concrete thrust blocks to support hydrant and prevent movement at all changes in direction of piping. Thrust blocks not required for Type K copper piping installation. Provide rods, clamps and retainer glands on all elbows and fittings in accordance with manufacturer's recommendations to prevent fitting from blowing off under line pressure. Coat all clamps, rods, nuts with two coats of bitumastic.

B. Minimum earth cover shall be 5 ft. - 0 in. unless otherwise noted.

C. Water mains crossing sanitary or storm sewers shall be installed to provide a minimum vertical distance of 1 ft. - 6 inches between the outside of the pipes where the water main is above or below the sewer. Locate the water pipe so that the crossing of the sewer occurs at the mid-section of a full length of pipe. The minimum horizontal separation between water mains and sewer mains shall be 10 ft. - 0 in. measured from the outside of the pipes. If separation or distance of joints from pipe crossing cannot be established, encase water piping in 6 in. concrete for a distance 10 ft. - 0 in. each side of crossing.

3.3 WATER METER

A. Provide pressure gauge on outlet side of meter. Provide line size strainer on inlet side of meter. Provide concrete base or pipe stands to support meter assembly. Provide bypass piping with sealed valve around meter.

B. The water meter assembly and piping arrangement shall be installed in accordance with the local Water Authority Standards.

3.4 BACKFLOW PREVENTERS

A. The backflow preventer installation shall be installed in accordance with the Health Department approved drawings.

B. Prior to installation of backflow preventers, obtain the approved drawings from the Engineer.

C. Provide hub style drain for emergency relief drain with a pipe separation of at least two (2) pipe diameters from backflow preventer relief outlet.

3.5 PIPING

A. Run slightly off level to low points; provide drain valves at low points. Provide shock absorbers where shown or specified. Branch headers serving flush valves shall be full size as shown. Exposed water piping in Kitchen shall be chrome plated brass (from insulation to fixture or equipment connection.). Provide dielectric pipe fittings when connecting to piping systems of dissimilar metals. All supply piping to fixtures, faucets, hydrants and flush valves shall be anchored to prevent movement.

B. Provide shock absorbers where flush valves and quick closing valves are used as specified in Section 223010.

3.6 ARRANGEMENTS

A. Provide for application to and obtain approval from the local Water Authority for connection to municipal systems.

B. Contact the Water Authority for the extent of their work, the costs, fees, required permits and their installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the base bid.

3.7 CLEANING AND DISINFECTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for domestic water piping cleaning and disinfecting requirements.

3.8 TESTS

A. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner.

B. Upon completion of construction, all backflow prevention devices provided under this contract shall be tested. Tests shall be performed by a certified backflow preventer tester registered by the New York State Department of Health. Provide three (3) copies of Form DOH-1013 for each device with Part A completed by the tester. Submit forms to Engineer. Pay all costs required for testing devices, including administrative costs associated with satisfying the requirements and regulations of Water Authority and Health Department. Repair or replace any device failing the test and repeat the test.

C. Test each vacuum breaker according to authorities having jurisdiction and the device's reference standard.

D. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION

SECTION 221300 - SANITARY, WASTE AND STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 PLUMBING DRAINAGE SYSTEM

A. Piping Materials: Refer to Section 221010, "Piping Systems and Accessories" and 221020, "Underground Piping and Accessories" for piping materials.

2.2 HYDROFLUSHING

A. The hydroflushing equipment used for sewer cleaning shall be designed and constructed for sewer cleaning and be capable of removing sludge, grease, dirt and other foreign materials. It shall consist of, but not be limited to, booster pump, high pressure hose, water spray jet, cutting nozzles and all accessories required to complete the work.

2.3 TELEVISION INSPECTION

A. The television camera used for inspection shall be designed and constructed for sewer inspection and shall be sufficient to allow a clear, visible picture. It shall consist of, but not be limited to, camera, TV monitor, videotape equipment and all accessories required to complete the work.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to commencing work, the Contractor shall verify inverts and locations. Any discrepancy between plans and field conditions shall be reported to the Owner or Engineer. No work shall start until discrepancies have been resolved. All costs related to Contractor's failure to verify and report discrepancies will be borne by the Contractor.

B. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.2 PIPE INSTALLATION

A. Minimum Slope: 2-1/2 in. and under - 1/4 in. per ft.; 3 in. to 6 in. - 1/8 in. per ft; 8 in. and larger - 1/16 in. per ft.

B. All underground sanitary piping shall be a minimum of 3 inch size and sloped no less than 1/4 inch per foot.

C. In all finished spaces, paint exposed waste piping 2 in. and over with chromium paint.

D. Slope piping as indicated on drawing; verify inverts given. Inspect piping before installation to detect apparent defects. Remove defective piping from site. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Install piping and gaskets in accordance with manufacturer's recommendations and other special installation requirements. Clean interior of piping of dirt and other foreign material as work progresses. Place plugs in ends of pipe at end of day or whenever work stops. Flush lines if required to remove collected debris.

E. Inspect piping to determine whether line displacement or other damage has occurred. Make inspections after lines have been installed and approximately 2 ft. of backfill is in place, and again at completion of project. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.

3.3 ARRANGEMENTS

A. Make arrangements and obtain approval of the local Sewer Department to connect to the municipal system.

B. Contact the local Sewer Department for the extent of their work, the costs, fees, required permits and installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the Base Bid.

3.4 HYDROFLUSHING

A. Upon completion of the project, mechanically auger and hydroflush clean all new buried sanitary, waste and storm drainage piping 4 in. and larger. Use cutting nozzles when applicable. Do not mechanically auger or use cutting nozzles when piping is clay tile or plastic piping.

B. Hydroflush piping utilizing full length of jet hose. Thoroughly flush all piping for 30 minutes upon completion of hydroflushing. Piping shall be clean.

C. Field check existing piping layout prior to commencement of cleaning operations. Take all precautions to prevent water leaks within the buildings.

D. Determine the existing sewer materials prior to cleaning. Should pipe be any material other than cast iron, do not proceed. Notify Owner's Representative.

E. All hydroflushing of drain lines shall be performed against the direction of flow of the waste water, unless otherwise noted.

F. Restore all areas disturbed to match existing.

G. The cleaning and flushing services shall be performed by one approved service firm.

3.5 TELEVISION INSPECTION

A. After completion of hydroflushing, furnish all labor, materials and equipment necessary to provide television inspection of all hydroflushed piping.

B. Provide a digital video copy accompanied with a written report and drawings locating all sources of infiltration, blockages and obstructions, broken pipe, collapsed pipe, misalignments, pipe sags and unusual conditions observed. The digital video copy and report shall be cross-referenced. Provide a copy of each to the Owner's Representative.

3.6 TESTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION

SECTION 223010 - EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Drain Description: All Floor Drains Type A unless otherwise noted.

1. Type A: Cast iron body, flashing collar with weepholes, nickel bronze, 7 in. diameter adjustable strainer; Jay R. Smith Figure #2010-A.

2. Type B: Cast iron body, flashing collar with weepholes, 8 in. diameter cast iron grate medium duty, removable sediment bucket; Jay R. Smith Figure #2110.

3. Type C: Cast iron body, flashing collar with weepholes, nickel bronze 7 in. diameter adjustable strainer with separate oval funnel; Jay R. Smith Figure #2010-A with #3590 funnel.

B. Where floor drains are not installed in slabs on grade, provide flashing collar and flash with 24 in. square four (4) pound lead flashing or equal.

C. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.2 FLOOR SINKS

A. Sink Description:

1. Type A: Acid resistant coated body with 12-1/2 in. square nickel bronze top, 8 in. deep with sediment bucket; Jay R. Smith Figure #3150.

B. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.3 CLEANOUTS

A. Floors: Cast iron body, nickel-bronze top with adjustable feature, bronze plug and flashing clamp where required, carpet marker and tile cover where applicable; Jay R. Smith Series #4028.

B. Walls: Cast iron ferrule, with bronze plug and stainless steel smooth access cover.

1. Horizontal: Jay R. Smith Figure #4402.

2. Vertical: Jay R. Smith Figure #4531.

C. Yard Cleanout:

1. Cast iron body, adjustable round heavy duty top, with tractor cover, vandal proof screws and bronze plug; Jay R. Smith Figure #4246.

D. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.4 WALL HYDRANTS

A. Exposed type hose connection, lead-free, solder connection, nickel bronze face, quarter turn valve, nonfreeze type, 3/4 in. hose connection, self draining, integral vacuum breaker with vandal resistant cap, loose key control and wall clamp; Jay R. Smith Figure #5609QT.

B. Make: Jay R. Smith, Prier, Watts, Woodford or Zurn.

2.5 HOSE BIBBS (INTERIOR)

A. Inside sill faucet, vacuum breaker, lead-free, solder connection, 3/4 in. hose thread outlet, lock shield cap, loose key control, flanged female inlet, polished chrome plate finish for finished rooms, rough chromium for unfinished rooms.

B. Make: Woodford Model 84, Prier, Chicago Faucets or Acorn in finished room; Chicago Faucets #998 in Mechanical Rooms, Boiler Room, Penthouse, or other unfinished rooms.

2.6 SHOCK ABSORBERS

A. Hydropneumatically controlled with permanently sealed expansion chamber pre-charged with non-combustible gas; lead-free, threaded connection, meets or exceeds Plumbing and Drainage Institute Standard PDI WH-201 and ASSE Standard 1010.

1. Bellows Type: Stainless steel construction with stainless steel bellows.

2. Piston Type: Hard drawn copper body with brass piston, cap and adapter, and elastomer seals.

B. Elastomer or rubber compound type bellows not allowed.

C. Make: Watts #LF15M2, Precision Plumbing Products, Jay R. Smith, or Zurn.

2.7 TRAP GUARDS

A. Elastomeric, normally closed seal to prevent evaporation of P-traps. Inserts into throat of floor drain.

B. Make: Zurn, “Zshield”.

2.8 WATER PRESSURE GAUGES

A. Pressure Gauge

1. Case: Stainless Steel case, non repairable

2. Dail Size: 3.5” Minimum

3. Media: Silicon Filled

4. Accuracy: 1%

5. Gauge Valve: Ball Valve

a. Guage cocks and Snubbers are not allowed

B. Make: Trerice, Weiss, Weksler, Winters.

2.9 PIPING SYSTEM THERMOMETERS

A. Industrial stick type

1. 9” aluminum or nonmetallic case, locking adjustable angle body, mercury free.

2. Secured to thermowell by tapered bushing

a. Set screws are not allowed

3. Thermowells: Brass

4. Accuracy: 1%

B. Light Powered Digital

1. Aluminum or high impact ABS case, glass passivated thermistor, LCD display, 0.5 inch minimum digits.

2. Secured to thermowell by tapered bushing

a. Set screws are not allowed

3. Thermowells: Brass

4. Accuracy: 1%

C. Make: Trerice, Weiss, Weksler, Winters.

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

A. Plumbing Contractor shall:

1. Provide all roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment requiring same as called for on Contract Documents.

2. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

3. Provide loose key stops, "P" traps, tailpieces, adapters, gas or air cocks and all necessary piping and fittings from roughing point to equipment.

4. Provide for installation of sinks, faucets, traps, tailpieces provided by an Equipment Contractor. These items to be delivered, in easily identified cartons, to the proper room for Contractor's installation.

5. Install controls and devices furnished by others.

6. Provide cold water line with gate valve and backflow prevention device at locations called for. Continuation and connection to equipment by others.

7. Install relief valve discharge piping from equipment relief valves.

8. Provide for Owner furnished equipment:

a. Connect complete and ready for use, including all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, etc., as required by Owner.

b. Refer to manufacturer Drawings and Specifications for requirements of Laboratory Equipment. Verify connection requirements before bidding.

3.2 CLEANOUTS

A. Install cleanouts out of traffic patterns and flush to floor. Provide offset from sanitary line served. Do not locate under doors or under lockers. Maintain distance between cleanouts on piping 4 in. and smaller, 50 ft.; over 4 in., 100 ft. At changes in direction greater than 45°. Install at base of soil, waste, vent, stacks and roof conductors and where called for.

B. Cleanouts: Same nominal size as pipe, but not larger than 4 in.

3.3 WALL HYDRANTS

A. Install minimum 24 in. above grade.

3.4 HOSE BIBBS

A. Install at low points of piping system.

3.5 SHOCK ABSORBERS

A. Install in vertical position.

3.6 THERMOMETERS

A. Provide on piping system where called for and shown, with thermometer well at each location, mounted in oversize tee or elbow to provide as little restriction as possible to fluid flow, stems or proper length to allow accurate reading. Arrange to be easily read from floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.7 PRESSURE GAUGES

A. Provide in piping system where called for and shown, with needle valve and pulsation damper or snubber at each location. Arrange to be easily read from the floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.8 TEMPERATURE MIXING VALVE

A. Provide where called for. Provide 2 ft. - 0 in. deep heat trap on hot water supply line ahead of connection to mixing valve.

B. Provide factory-trained technician to start up, adjust and inspect the mixing valve and piping for correct installation and temperature adjustment.

3.9 TRAP GUARD

A. Provide for each new floor drain.

END OF SECTION

SECTION 223400 - WATER HEATERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work of this section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions, General Requirements and Basic Mechanical/Electrical Requirements.

B. Provide labor, materials, equipment and services to perform work and related work required by Contract Documents for a complete operating system.

1.2 SUBMITTALS

A. Submit manufacturer's data for approval in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all products to be installed including, but not limited to:

1. Water Heater.
2. Protective Valves.
3. Expansion Tank.
4. All Heater and Tank Accessories.
5. All System Wiring Diagrams.

1.3 SPECIAL COORDINATION

A. Coordinate all work of other trades in Mechanical Room.

B. Furnish Division 26 "Electric" with dimensional drawings showing location of electrical connections, location of equipment mounted on walls, and of other equipment requiring electrical connections, removals or replacements.

PART 2 - PRODUCTS

2.1 WATER HEATER – WATER TO WATER PACKAGED WATER HEATER

A. Mounted on 16 gauge enameled metal bare, factory assembled including electronic operated 3 way valve.

B. Bronze T & P relief valve conforming to ANSI Z21.22 and 2” bronze ball type shell drain valve.

C. Double walled copper, brazed 316L stainless steel plates.

D. Refer to drawings for Water Heater Schedule.

E. Accessories:

1. Microprocessor based temperature controller.

2. Over temperature limit system.

3. Temperature switch.

4. Solenoid valves.

5. Indicator lights.

6. Hot water outlet temperature.

7. Pressure temperature relief valves.

F. Design Equipment: Cemline.

G. Acceptable Manufacturers: Aerco, Cemline.

2.2 THERMAL EXPANSION TANK

A. Vertical steel expansion tank constructed and designed per ASME Code Section VIII, 125 PSI working pressure, steel outer shell, rigid polypropylene liner, heavy duty butyl rubber diaphragm and non-ferrous system connection tapping, suitable for potable hot water, factory pre-charged.

B. Design Equipment: Amtrol.

C. Acceptable Manufacturers: Amtrol, Watts, Wessel or approved equal.

2.3 PROTECTIVE VALVES

A. Pressure Relief Valves:

1. ASME stamped and rated.

2. Open at 125 lbs. pressure sized for full heating capacity.

3. Make: Bell & Gossett, Kunkle, Watts or approved equal.

B. Temperature and Pressure Relief Valve:

1. ASME stamped and rated (for steam or hot water).

2. Size for full heat input.

3. Complying with Federal Spec. MIL-V-13612C.

4. Valve shall be sized and selected by manufacturer for tank and heater installed.

5. Make: Camco, Cash-Acme, Watts, or approved equal.

PART 3 - EXECUTION

3.1 WATER HEATERS

A. Install each heater on a 6 in. high concrete pad.

B. Pipe pressure and temperature relief valve drain to discharge to nearest floor drain.

C. Provide all electric wiring and equipment in accordance with manufacturer's wiring diagrams and instructions. Make all final connections.

D. Provide all piping, valves and fittings in accordance with manufacturer's piping instructions. Make all final connections.

E. Provide equipment in accordance with contract drawings and all local codes.

F. Provide start-up services of a factory trained technician to inspect the installation based on factory recommendations. Items include but are not limited to:

1. Verification of proper piping arrangement.

2. Verification of proper temperature rise across heater(s).

3. Operating and safety controls.

4. Proper operation of equipment.

5. Verification of piping arrangement and aquastat location.

6. Relief valve settings and AGA BTU capacities.

7. All control settings.

G. Submit three (3) copies of startup reports in writing with all factory checkout data signed by the factory authorized service agent to the Owner's Representative.

H. Place equipment in operation.

I. The installation of water heaters shall be based on the details shown on the drawings and specified in this Section. Approved water heaters provided other than type shown or specified shall be installed in accordance with manufacturer's recommended installation instructions and piping diagrams.

3.2 INSTANTANEOUS WATER HEATERS

A. Install instantaneous type water heaters as recommended by the manufacturer. Place and secure anchorage devices to building structure. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 - Products of this section.

1.3 DESCRIPTION OF FIXTURES

A. Fixtures and trim shall be of those manufacturers listed, unless otherwise indicated. Fixtures for this project shall be of same manufacturer.

1. Fixtures: American Standard, Kohler, Mansfield, Sloan, Toto, Watts or Zurn.

2. Faucets: Chicago Faucets, Delta, Moen, Symmons, T&S Brass or Zurn. All faucets shall be lead-free in accordance with NSF 61 and NSF 372.

3. Lab Faucets: Watersaver, Chicago Faucets

4. Flushometers: Sloan "Regal XL" or Zurn.

5. Closet Seats: Bemis, Beneke, Church or Olsonite.

6. Fixture Carriers: Jay R. Smith, Watts, Wade, Josam or Zurn.

7. Sinks: Elkay, Just or Kohler.

8. Water Coolers: Elkay, Haws, Murdock or Oasis.

9. Supplies, Stops and Traps: Brasscraft, EBC, McGuire or Sanitary Dash.

B. Exposed parts of trim shall have polished chrome plated finish.

C. Tubular drainage products ("P" traps, nipples, etc.) shall be 17 gauge brass.

1.4 QUALITY ASSURANCE

A. Comply with requirements of the Plumbing Fixture Law of the New York State Department of Environmental Conservation.

B. Comply with the American Disabilities Act Guidelines and ANSI A117.1 "Accessible and Usable Buildings and Facilities".

C. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard 61, Section 9 Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third-party testing and certification.

D. All fixture trim used to convey water for potable use shall be lead free.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

A. WC-A (HDCP):

1. American Standard #2257.101 Afwall, wall hung, vitreous china, siphon jet, elongated bowl, 1.28 GPF, fully glazed 2 in. ball pass trapway, with 1-1/2 in. top spud, fitted with following:

   a. Sloan #ECOS111-1.28-LT, 1.28 GPF, sensor operated, hard wired powered, closet flushometer, for left or right hand supplies, exposed diaphragm type, 1 in. screwdriver angle stop with vandal resistant metal cap and replaceable sensor window, bumper on stop, vacuum breaker, adjustable tailpiece, sweat solder adaptor kit and cast wall flange with set screw, override button, with adjustable sensor on centerline of fixture, WaterSense Listed.

      1) Solenoid extension nipple option to protect low voltage wiring from wall plate to solenoid.

      2) Sloan #EL-485-A flushometer electrical box positioning and support kit.

      3) Sloan #EL-154, 120 volt transformer. Refer to plans for locations and quantity required.

      4) Plumbing Contractor shall furnish transformer(s) and provide low voltage wiring. Electrical Contractor shall install transformer(s) and provide power to transformer.

   b. Church #9500SCC, extra heavy weight, white elongated solid plastic, open front closet seat with self-sustaining check hinge, less cover.

   c. Jay R. Smith Series 200 closet fittings and carrier.

      1) Mount at ADA required height and location or as shown on Architectural drawings.

2.2 LAVATORIES

A. LAV-A (HDCP):

1. American Standard #0954004EC, 20-7/8 in. x 22-1/16 in. wall hung, vitreous china lavatory with 4 in. centers, overflow, self-draining deck and faucet ledge, fitted with the following:

a. Sloan EAF-100-HLT-ISM-CP-0.35-MLM-IR-IQ-FCT, lead-free sensor faucet, deck mounted, 4 in. centers, swing plain end gooseneck spout with 0.35 GPM flow control device in spout base, ADA compliant. Hard wired, trim plate for 4" centers, integrated side mixer, water sense listed.

b. McGuire #155WC offset chrome plated P.O. plug with open grid strainer and 1-1/4 in., 17 gauge offset tailpiece.

c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.

d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers, cast brass escutcheon with set screws.

e. Jay R. Smith Series 700 concealed arm floor mounted carrier with rectangular uprights.

f. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".

g. Mount at ADA required height and location or as shown on Architectural drawings.

2.3 SINKS

A. SK-A (HDCP):

1. This fixture will be supplied and set in place by the General Contractor (GC). This Contractor shall provide faucet, drain tailpiece, stops, traps, adapters, piping, and fittings to the fixture. Provide the following:

a. This faucet will be supplied and set in place by the General Contractor (GC).

b. Town &Country #PP-27MT polypropylene 1-1/2 in. jar-type deep seal P-trap with unscrewable cleanout jar. Threaded 90° ells when water piping is through floor. Size to match sink tailpiece.

c. Polypropylene 3 in. open grid strainer and tailpiece.

d. McGuire #LF2167LKF, lead free, 1/2 in. supplies with 1/2 in. O.D. flexible risers, loose key stops and cast brass escutcheons with setscrews.

e. Provide ADA insulation on exposed waste and supplies.

B. SK-C (HDCP):

1. Elkay Lustertone ELUHAD211555PD, 23 1/2 in. x 18 1/4 in. x 5 3/8 in. deep, nickel type 304 stainless steel single bowl sink, ADA compliant, 18 gauge, undermount installation, fitted with the following:

a. Chicago #201-GN2AE3-317XKAB two handle concealed mount sink faucet, 11-5/8 in. high, 5 3/8 in. reach swing spout, pressure compensating aerator, deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:

1) 1.5 GPM aerator.

2) #317, 4 in. wrist blade handles

3) ADA complaint.

b. Elkay #LKAD18 stamped brass drain outlet with 3 in. perforated grid strainer and LKADOS 1-1/2 in. O.D. offset tailpiece.

c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

2.4 MOP BASINS

A. MB-A:

1. Fiat Model MSB, molded stone, 24 in. x 24 in. x 10 in. deep, stainless steel flat strainer, 2 in. outlet with the following:

a. T&S Brass #B-0665-BSTP, lead-free, exposed wall mounted faucet with integral stops, rough chrome finish, lever handles, top brace spout with bucket hook, hose end and vacuum breaker.

b. Fiat # 832AA Hose and Hose Bracket.

c. Fiat #889CC Mop Hanger.

d. Fiat # E77AA Vinyl Bumper guard on exposed sides.

e. Fiat #MSG 24 Stainless Steel Wall Guard.

f. Provide silicone sealant between wall, floor and mop basin.

2.5 ELECTRIC WATER COOLER

A. EWC-A:

1. Elkay #EZS8WSLK, wall mounted, ADA compliant, lead-free construction, one piece stainless steel basin, vandal resistant stream saver bubbler, self-closing front and side push bar control with in-line stream regulator, adjustable temperature control, permanently sealed and lubricated fan motor, hermetically sealed compressor and control, 1/5 HP, 120V, capacity of 8.0 GPH of 50°F water at 90°F ambient and 80°F inlet water. Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 20 second shutoff timer, bottle counter, antimicrobial protected plastic components. Capacity of 1.0 GPM flow rate with laminar flow to minimize splashing.

a. McGuire #LF165LKE, lead-free, 3/8 in. lavatory wall supply with loose key angle stop, 3/8 in. flexible riser, and cast brass escutcheon with set screw.

b. McGuire #8902, 1-1/4 in. x 1-1/2 in. semi-cast brass "P" trap with cleanout and cast brass escutcheon with set screw.

c. Jay R. Smith floor mounted carrier with rectangular uprights.

d. Acceptable Manufacturer: Elkay, Halsey Taylor.

2.6 EMERGENCY FIXTURES

A. EEW-A: (for the physically challenged)

1. This fixture will be supplied and set in place by the General Contractor (GC).

2. Emergency fixture thermostatic mixing valve meeting ASSE 1071, and cold water by-pass.

B. EEW-B:

1. Water Saver EW1014BP-TMV, Wall mount eyewash/drench unit, 12 inch coated hose with stay open valve, and backflow preventer, universal identification sign and meeting ANSI Z358.1, with emergency fixture thermostatic mixing valve meeting ASSE 1071, and cold water by-pass.

C. ES-A: EMERGENCY SHOWER:

1. Water Saver SSBF2170 recessed; Barrier free drench shower meeting 2358.1, stainless steel showerhead and enclosure, 1" NPT stay open valve.

PART 3 - EXECUTION

3.1 FIXTURES, EQUIPMENT AND SYSTEMS

A. Install fixtures, equipment and systems as shown on Drawings or specified herein in accordance with provisions of each applicable Specification Section and all local and state codes having jurisdiction.

3.2 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers written installation instructions.

B. Carefully drill holes for through bolts to avoid chipping blocks or plaster.

C. Except where carriers are specified, attach hangers or brackets to walls as follows:

1. Masonry Construction: Secure fixture hangers to partition by thru-bolts extending through a steel plate on opposite side of partition. Obtain Owner's Representative's approval prior to work.

2. Metal Stud Construction: Anchor backing for fixtures or equipment to 1/8 in. x 12 in. steel plate bolted or riveted to at least three studs. Obtain Owner's Representative's approval prior to work.

D. Anchor carriers to concrete floor with 1/2 in. x 3 in. anchor or thru-bolts and washers. Provide for drilling of floor and installation of expansion shields. Quantity of anchors:

1. Water Closets - Four (4).

2. Lavatories - Eight (8).

E. Seal fixtures in contact with walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone caulk. Match color to fixture color.

F. Set self-rimming lavatories and sinks in a bed of silicone caulk.

G. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.

H. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.

I. Fasten counter-mounting-type plumbing fixtures to casework.

J. Immediately after installation, provide protective covering over fixtures and trim.

3.3 MOUNTING HEIGHT AND LOCATION

A. Mount fixtures at height and location as indicated on Architectural plans and elevations.

B. Mount accessible fixtures in conformance with the requirements of ANSI A117.1.

3.4 CONNECTIONS

A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

3.5 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Adjust water pressure at electric water coolers, faucets and flush valves to provide proper flow and stream.

C. Replace washers of leaking and dripping faucets and stops.

D. Clean fixtures, fittings, spout and drain strainers with manufacturers' recommended cleaning methods and materials.

E. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components and retest. Repeat procedure until all units operate properly.

END OF SECTION

SECTION 226700 - WATER TREATMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform work and related work required by Contract Documents for a complete operating system.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements and Division 01. Obtain approval prior to ordering material.

B. Provide submittals for all products specified under Part 2 of this Section as well as the following:

1. All pretreatment equipment including electrical devices and controls.

2. All post-treatment equipment including electrical devices and controls.

3. Wiring diagrams for all electrical power and control connections.

4. Final equipment layout.

5. Final piping layout.

1.3 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the equipment manufacturer's specifications and instruction manuals.

B. Equipment selected to provide a complete water treatment system shall be supplied by a single manufacturer. Items purchased from various manufacturers will not be accepted.

C. The equipment manufacturer shall have at least five (5) years experience with water treatment installations

PART 2 - PRODUCTS

2.1 PIPING

A. Refer to Specification Section 221010, "Piping Systems and Accessories".

2.2 VALVES

A. Refer to Specification Section 220523, "Valves".

2.3 CARBON FILTER

A. Provide one (1) fiberglass tanks, as follows:

1. Tank Size: 18 in.

2. Service Flow: 8.85 GPM.

3. Backwash Flow: 10-12 GPM.

4. Electrical Requirements: 120/1/60.

5. Regeneration Initiation: NEMA 1 Timeclock.

B. Design Equipment: ATS SAF-3-1.5

2.4 WATER SOFTENERS

A. Provide duplex fiberglass softener system complete with valves, meters, brine tank, multi-port valve controller, Fiberglass tank, as follows:

1. Tank Size: 18 in. diameter by 65 high (overall height 73 in) with adjustable jack supports.

2. Service Flow: 27 GPM, continuous operation.

3. Backwash Flow: 9 GPM.

4. Pipe Size: 1-1/2 in.

5. Electrical Requirements: 120/1/60.

6. Regeneration Initiation: NEMA 1 Timeclock.

7. Upper Manifold: Galvanized header and laterals with outlets.

8. Lower Manifold: PVC hub laterals and nozzles. Supporting bed 1'-0" deep consisting of three or more grades of washed quartz gravel.

9. All equipment guaranteed for a period of one (1) year.

10. Necessary salt, etc., for placing unit in operation.

B. Provide single fiberglass brine tank as follows:

1. Tank Size: 24 in. diameter by 41 in. high.

2. Capacity: 500 grains.

3. Salt Storage: 30 lbs.

4. Design Equipment: ATS DTS 95-18.

5. Acceptable Manufacturers: Bruner, Elgin or Lakeside

2.5 REVERSE OSMOSIS

A. Provide reverse osmosis system as follows:

1. Product Flow: 10 GPM / 15,000 GPD.

2. Feed Flow: 11 GPM.

3. Recovery: 75%

4. Pipe Sizes: 1 in.

5. Number of Membranes: 5.

6. Pump Type: Centrifugal, 2 HP, 460/60/3.

7. Provide unit with sample valves, flow meters, pressure gauges, high pressure tubing, instrument panel and all required components for a complete operational unit.

8. Design Equipment: REO-Pure BLS-15000.

2.6 STORAGE TANK

A. Provide one (1) 500 gallons, FDA approved polyethylene supported by a structural steel stand painted with acid resistant epoxy, cone bottom, as follows:

1. Storage Capacity: 500 gallons.

2. Tank Size: 48 diameter x 85 height.

3. Fittings:

a. Fill: One (1) 1-1/2 in. NPTF.

b. Return: Two (2) 1-1/2 in. NPTF.

c. Overflow: One (1) 1-1/2 in. NPTF.

d. Outlet: One (1) 1-1/2 in. NPTF.

e. Vent: One (1) 1-1/2 in. NPTF.

f. Level/Sight Fittings: Two (2) 1 in. NPTF.

4. Top: Flat, bolted and gasketed full cover.

5. Sterile Vent: Polypropylene housing and cap, 10 in. length; polypropylene cartridge, 10 in. length, 0.02 micron absolute.

B. Design Equipment: Pru Tank.

2.7 DISTRIBUTION PUMP (RO/DI WATER SYSTEMS)

A. Provide vertical, multi-stage centrifugal pump, 316 stainless steel construction, TEFC, non-overloading motor and to include the following:

1. Pump Capacity: 10 GPM.

2. Discharge Head: 31 PSI.

3. Electrical Requirements: 60 HZ, IP, 115/230.

4. Inlet/Outlet: 1 in.

B. Design Equipment: Grundfos #97568279 CM3-2 Multi Stage.

2.8 BACK PRESSURE REGULATING VALVE

A. Provide Plast-O-Matic Model RVT, back pressure regulating valve constructed of Type 1, Grade 1, CPVC with solid Teflon shaft.

2.9 METERS AND GAUGES

A. Pressure gauges shall be liquid filled, with 1/4 in. NPT stem mount, 2.5 in. dial face, stainless steel exterior, stainless steel intervals, 0 - 160 PSI range.

B. Resistivity/Conductivity meter shall be Thornton Model No. 200 CR and shall measure the system conductivity, resistivity, temperature and TDS. Enclosure shall be NEMA 4X complete with connectors and cable. Electrical Requirement: 120/1/60. Unit shall have analog output that is capable of being monitored by the BACS.

C. Flow meter shall be Signet Model flow meter and volume totalizer. Flow meter shall be displayed on a sleeved bearing, 250° meter movement, 4-1/2 in. diameter face with 1 in. connection. Unit shall be complete with 1 in. tee and MK-515-IPSO Flo sensor. Unit shall have analog output that is capable of being monitored by the BACS. gallons per day generation.

D. Thermometers shall be be bimetal dial type, stainless steel case, 4 1/2 in. diameter, white dial face with black numbers, stainless steel stem for separable socket with thermowell. Provide with temperature range of 30°F - 240°F.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications.

B. The system manufacturer shall provide startup supervision by a qualified technical representative.

C. The manufacturer shall warrant all equipment for a period of one (1) full year from the time of satisfactory equipment start-up.

D. The manufacturer shall supervise the installation of the equipment and verify that the equipment produces the quality and quantity of water specified.

3.2 TESTS

A. Test all system piping with inert gas (Nitrogen) at a pressure of 1.5 times the system operating pressure. The pressure shall remain constant without a drop in pressure for one hour.

B. Entire piping system shall be cleaned, flushed, sterilized and rinsed with hydrogen peroxide prior to being put into service. Work shall be performed in accordance with the system manufacturer.

3.3 INSTALLATION OF PIPING

A. Plastic coated hangers and riser clamps shall be used to protect the PVC piping from wear.

B. Install air release valve at the high point of the piping system on the top floor to assure that the system can be completely vented.

C. Minimize dead legs in piping system to six (6) pipe diameters in length from main to equipment connections.

D. Do not conceal piping until inspected by the Owner's Representative.

E. Engage factory authorized service representative to test and inspect components, assemblies, and equipment installations including connections. The factory-authorized representative shall also provide start-up services and balancing of system. Both the existing and new systems shall be included.

3.4 TESTING OF PIPING SERVING LABORATORIES

A. The piping system shall be tested to a hydrostatic pressure equal to 1-1/2 times the system’s normal operating pressure or 125 PSIG, whichever is greater.

B. The water used for the pressure test shall be supplied from an independent water source; water must be compatible with the purified water system.

C. Repair any damage caused by the tests.

D. Delicate control mechanisms shall be removed to prevent shock damage during testing.

E. Leaks shall be repaired by removing the device that is leaking and reinstalling new materials and joints. Use of mastic or no-leak compounds shall not be permitted.

3.5 CLEANING OF PIPING SERVING LABORATORIES

A. Before placing in service, the existing and new water piping systems shall be cleaned, flushed and disinfected.

B. Based on the volume of water in the storage tanks and piping systems, provide 50% hydrogen peroxide dilution to a 3% solution for disinfection.

C. Drain a sufficient amount of water from the storage tanks to allow for the addition of the hydrogen peroxide. Bypass any equipment in the piping system that is not compatible with hydrogen peroxide (i.e. filters, carbon and resin tanks, etc.)

D. Using a suitable chemical transfer pump, add 50% hydrogen peroxide solution to the storage tanks. Fill the remaining volume of the storage tanks with reverse osmosis water.

E. Turn on the distribution pump and allow a minimum of 30 minutes for the hydrogen peroxide concentration to equalize.

F. Starting on the upper floors, open each faucet for several minutes to drain the hydrogen peroxide through the piping system and faucet. Using a hydrogen peroxide kit, test random faucets for the presence of hydrogen peroxide. If hydrogen peroxide is not detected, continue drawing water from the faucets until hydrogen peroxide is detected. Do not use more than 10% of the water from the storage tank.

G. Retain hydrogen peroxide solution in the piping system and the storage tank for a minimum of 2 hours.

H. Drain the hydrogen peroxide solution from the piping system and storage tank.

I. Refill the piping system and storage tank with RO/DI water and start flushing the system by opening all faucets in the piping system.

J. Using a hydrogen peroxide kit, check random faucets for the presence of hydrogen peroxide. Continue to flush faucets until no hydrogen peroxide residual is present.

3.6 ADJUSTING AND BALANCING

A. Adjust and balance the laboratory grade water system and appurtenances to deliver the water quantities as specified. Modify pumps and/or controls to produce the design flow.

3.7 CLOSEOUT (THE FLOOWING INFORMATION MUST BE SUBMITTED PRIOR TO FINAL SYSTEM ACCCEPTANCE):

A. Testing reports

B. Complete installation and maintenance manuals with the installed equipment clearly marked.

C. Asset manager upload documentation.

END OF SECTION

SECTION 227010 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide manufacturer's data sheets and installation instructions for all equipment and accessories in this section in accordance with Basic Mechanical/Electrical Requirements and Division 01.

1.3 QUALITY ASSURANCE

A. Follow all requirements, recommendations, and appendices to comply with the following publications, codes, standards, and listings:

1. 2020 Fuel Gas Code of New York State

2. American Gas Association.

3. Local Utility Company.

B. Provide equipment and accessories that are listed and labeled by a nationally recognized testing laboratory.

1.4 GAS SERVICE

A. The existing gas service will be reused.

1.5 GAS PRESSURE

A. The maximum allowable gas pressure inside the building is 1/2 psi.

PART 2 - PRODUCTS

2.1 GAS PIPING

A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories"

B. All exposed exterior and interior piping shall be primed and painted with one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel. Color shall be as selected.

2.2 VALVES

A. Refer to Specification Section 220523, "Valves".

PART 3 - EXECUTION

3.1 ARRANGEMENTS

A. Make arrangements with NYSEG**.**

B. Contact the utility company for the cost of the service, its fees and required permits. Pay all costs and include within the base bid.

C. Coordinate all service requirements with the utility company.

D. The contractor shall arrange for the plumbing inspector to inspect the gas piping and vent installations upon completion including underground and rough-ins, as well as installation of gas-fired appliances.

3.2 GAS DISTRIBUTION SYSTEM

A. Provide shutoff valve at the meter outlet. Provide all parts and accessories needed to connect to meter.

B. Furnish sleeve and sealing element for above ground gas piping entry through outside wall. Make entry gas and watertight.

C. Provide distribution system from existing piping, including mains, risers, branches, drips, shut-offs and other required parts. Connect to appliances indicated or specified as requiring gas for their operation.

3.3 PIPING INSTALLATION

A. Install gas piping at a uniform slope of 1/4 in. in 15 ft. to prevent traps. Horizontal lines shall slope upward to risers to the equipment.

B. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing. The sediment trap shall be installed in the gas supply line to gas fired equipment. The trap shall be a tee fitting having a threaded capped nipple installed vertically in the bottom most opening of the tee.

C. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down. Connect branch piping from top or side of horizontal piping.

D. Install unions in pipes 2 in. and smaller, adjacent to each valve, regulator and at final connection to each piece of equipment. Unions are not required on flanged devices.

E. Provide pressure regulator in supply to each gas fired appliance as required.

F. Install valve and strainer on the supply side of each gas pressure regulator.

G. Install vent piping for gas pressure regulators and gas trains, extend outside building and vent to atmosphere. Terminate vents with turned-down reducing elbow fittings with corrosion-resistant insect screens in large end.

H. Install containment conduits for buried gas piping within building in gas-tight conduits extending 12 in. minimum outside building and vented to atmosphere. Terminate vents with turned-down, reducing elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal tar epoxy.

I. Install pressure-relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.

3.4 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by the Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth; remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in. for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. Exercise caution to prevent heat related damage to plastic parts within the gas meter or regulators.

B. Welder qualifications: Welded piping fabricated by certified welder. Welder shall be certified under ASME or API Code III.

3.5 CONNECTIONS

A. Install gas piping next to gas-utilizing equipment and appliances for servicing and maintenance. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections to equipment downstream of valves and unions with flexible connectors. Valves, unions and flexible connectors shall be same size as the gas supply piping to the equipment.

B. Install a gas valve upstream within 6 ft. of each gas-utilizing appliance. Install a union connection downstream from the valve to permit removal of controls.

C. Sediment Traps: Install full size threaded tee fittings forming drips, as close as practical to gas appliance inlets. Cap or plug bottom outlet.

3.6 GAS PIPING TESTS

A. Test natural gas systems according to 2020 Fuel Gas Code of New York State and the local utility requirements unless otherwise noted:

1. Test pressure shall be 1-1/2 times working pressure, but not less than 3 psi for two (2) hours for steel piping.

2. Pressure testing of plastic piping shall be per utility's requirements.

B. Tests shall be witnessed by utility company. Make arrangements, provide all necessary items to complete testing and pay all costs.

C. All tests shall be performed prior to the connection of equipment. Regulator shall be isolated from test pressures. Soap test shall be conducted on all joints. Repair leaks and defects with new materials. Retest system until satisfactory results are obtained.

D. Verify correct pressure settings for pressure regulators.

E. Provide written certification that tests have been conducted and satisfactorily completed. Submit to Owner's Representative.

3.7 GAS LINE PURGING

A. At completion of pressure test, purge all natural gas systems according to 2020 Fuel Gas Code of New York State and the utility company requirements.

B. Provide three (3) days notice to utility company to have the meter unlocked for service and equipment start up. Make all arrangements and pay all fees as required by the Utility Company.

END OF SECTION

SECTION 230500 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final steam, condensate, hot water, chilled, drain connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent, gas, air, vacuum, lab gas connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

END OF SECTION

SECTION 230504 - ELECTRIC WIRING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of motor control wiring and temperature control wiring as required in Contract Documents. Provide wiring and conduit, required to connect devices furnished as part of or adjunctive to the automatic temperature control system and for motor control regardless of the source of supply. Control wiring includes 120 volt, lower voltage wiring and data network system for control signals directing equipment operation. Control circuits shall be 120 volt maximum. Provide wiring in accordance with requirements specified in Division 26 "Electrical" and the National Electrical Code. Provide devices required for proper system operation, including special electrical switches, transformers, disconnect switches, relays, and circuit breaker protection.

B. Coordinate all work with Division 26 "Electrical".

C. Coordinate all work with Division 27, "Communications".

1.2 WORK NOT INCLUDED

A. Power wiring for motors, motor starters and associated starting and control equipment, as well as the motor starters (except in the case of equipment specified to have packaged control/starters), are included in Division 26 "Electrical", unless otherwise called for.

1.3 QUALIFICATIONS

A. Wiring shall be installed in compliance with all requirements of Division 26 "Electrical".

B. Wiring shall be installed in compliance with all requirements of Division 27, "Communications".

1.4 SUBMITTALS

A. Provide complete wiring diagrams for equipment systems. Deliver wiring diagrams to proper trades in time for roughing of conduit, equipment connections, and avoid delay in construction schedule. Wiring diagrams and roughing information to be wired as part of the Work of Division 26 & 27, "Electrical" & “Communications”, shall be clearly indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Control Wiring:

1. Refer to Division 26 specifications for required wiring materials.

2. Unless specifically required otherwise by the BACS equipment manufacturer, all I/O wiring shall be twisted shielded cable.

B. Conduit:

1. Refer to Division 26 specifications for type of conduit to be used in specific applications.

2. All conduit containing control wiring shall be green.

PART 3 - EXECUTION

3.1 GENERAL

A. Check electrical wiring pertaining to equipment for completeness and correctness of connections. Correct any misapplied motor and/or motor starter, improper thermal overload device, or device which fails to function and resultant damage, whether due to incorrect connections or improper information on wiring diagrams.

3.2 WIRING FOR CONTROL SYSTEMS

A. Provide motor control and temperature control wiring for equipment. All wiring shall be in conduit, unless otherwise noted below, supported on 5ft. centers.

1. Provide 18 in. length flexible conduit at motors and devices subject to vibration.

2. Do not attach directly to hot surfaces, piping, or ductwork.

3. Control wiring shall be in separate conduit and raceway from all other wiring.

4. Control wiring shall be un-spliced from the controller to the sensor or device and shall be labeled at all points of termination.

5. For sensors with twisted shielded pair cable, the shield shall be ground at the panel and taped back at the sensor.

6. All control wiring shall be run in conduit within the following locations:

a. Mechanical rooms or other spaces in which it is readily accessible.

b. Interstitial spaces

1) Control wiring can be run in either conduit, cable tray or raceway.

c. Vertical chases.

d. Above non-accessible ceilings.

e. Accessible ceilings within laboratories.

f. Air Handling Units.

7. Where allowable by Code and contract documents, temperature control wiring may be installed without conduit. Installation and wire insulation types shall be as described by NEC, Article 725. All low voltage wiring circuits 50 volt and under shall:

a. Have the proper insulation and meet the requirements of NEC Article 300-22 when installed above accessible ceiling spaces.

b. Be adequately supported using bridle rings spaced a maximum of 3 ft. on centers or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.

c. Be run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.

d. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.

B. Provide pushbutton stations, pilot lights, selector switches, auxiliary starter contacts, and other devices required to provide specified functions.

1. Provide green grounding wire circuited from starter, and run ground wire through conduit to each remote auxiliary relay, pushbutton station, remote panel heating device, thermostat, or device with potentials in excess of 50 volts. Size ground wire as required by NEC.

3.3 EQUIPMENT WIRING

A. Provide power and control wiring between sections of electrical radiation units, between shipping splits, and between remote panels, thermostats, disconnect switches, and their respective units. Provide control wiring from the package control system, to each respective electric heat coil, reheat coil or motor. Properly mount control package. Power wiring to and including disconnect switch shall be by Division 26, "Electrical".

3.4 FIELD WIRING IN STARTERS, CONTROLLERS AND PANELS

A. Wiring within starters, controllers, and temperature control panels, shall be routed neatly in gutter space, away from moving and/or heat producing parts. Provide suitably rated terminal blocks. Do not place more than two wire connections on pilot device or relay terminal. Where more than two circuit connections are required, use terminal blocks. Provide nylon insulated, ring spade terminal for all control wires. Cables and wires shall be neatly bundled and lashed with nylon cable straps.

END OF SECTION

SECTION 230513 - MOTORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Submit manufacturer's product data on all motors.

B. Product Data: For each motor, provide dimensions; mounting arrangements; frame type, enclosure type, location for conduit entries; shipping and operating weights; and manufacturer's technical data on features, performance, electrical ratings and characteristics.

C. Motor Performance Data: For each motor, include the following manufacturers' data:

1. Motor Performance: Percent Efficiency, Power Factor, Torque, RPM, Duty Rating and Design Category.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Motor manufacturer shall be based and headquartered in the United States of America and shall design and manufacture motors in the United States.

2. Motor manufacturer shall have over fifteen (15) years-experience in the motor industry and shall maintain active company-wide quality assurance program.

3. Motor manufacturer shall maintain an authorized service center within 60 miles of the project site, capable of providing training, parts and emergency maintenance and repairs.

B. Motor performance shall be warranted against material and workmanship defects by manufacturer's limited warranty and service policy for the period of at least 18 months from the day of shipment from the factory or the manufacturer's warehouse.

1. Premium efficiency motors shall be warranted for 36 months.

2. Severe duty motors (as applicable) shall be warranted for 60 months.

3. Extended warranty shall be offered for certain products or as agreed by additional terms and specified elsewhere.

PART 2 - PRODUCTS

2.1 MOTORS

A. General Requirements:

1. Motors built for 60 Hz operation, three phase for 1/2 HP and larger; single phase for 1/3 HP and smaller.

   a. In compliance with NEMA Standards, wound specifically for nameplate voltage, and selected for appropriate duty and environment.

   b. 1.15 minimum service factor at rated voltage and frequency. 1.0 service factor for inverter duty motors.

   c. Bearings: Bearings shall have a rated fatigue life of L-10 (B-10) of 150,000 hours for direct-coupled applications and 50,000 hours for belted applications minimum. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG 1-14.43. The calculation will be determined from the pulley centerline being at the end of the motor shaft.

   d. V-belt connected motors with adjustable slide rail bases and pulleys.

   e. Motors shall have Class F insulation system, with Class B temperature rise, insulation meeting NEMA MG 1 Part 31. Maximum allowable motor temperature rise for open drip-proof or totally enclosed fan cooled (TEFC) type at 1.15 service factor shall be 105°C above 40°C ambient with a total temperature rating of 155°C.

   f. NEMA locked rotor kVA code as required to match unit equipment torque characteristics.

   g. Single-phase motors shall be capacitor start, induction run, or split phase type.

   h. Polyphase motors shall be constant speed, squirrel cage, unless otherwise specified.

   i. Nameplates shall have as a minimum, all information as described in NEMA Standard MG-1-20.60. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins.

2. Motors for use with adjustable speed drive applications shall be premium efficiency inverter duty rated in accordance with NEMA and be capable of a 20:1 turndown.

   a. These motors shall meet NEMA corona inception voltage requirements, withstanding peak voltages up to 1600 volts, and be manufactured in accordance with NEMA MG 1 Part 30 and 31.

b. All motors controlled by adjustable speed drives shall be equipped with circumferential micro-fiber shaft grounding rings to provide protection from electrical bearing damage, to meet NEMA MG 1, 31.4.4.3. Provide AEGIS Bearing Protection Ring Kit (or equal), installed in accordance with the manufacturer's recommendation. For motors controlled by adjustable speed drives and 50hp or greater the motor shall have a ceramic electrically insulating bearing assembly on the opposite end of the grounding brushes

3. EC Motors:

a. The motor shall be DC rated with permanent magnet rotor and automatically resetting integral overload protection.

b. The unit shall meet the scheduled voltage, phase, control and other requirements indicated.

c. Input Control: The unit shall have the following control features as a minimum:

1) Packaged Unit controls: DDC input to include start/stop/status/general trouble.

2) External Control: Minimum of Modbus and/or BACnet digital start/stop, digital trouble, 0-10VDC and 4-20mA speed control input.

d. Unit insulation shall be Class H.

e. Electrical termination lugs shall be suitable for the intended feed circuit.

f. Ratings shall be 90% minimum power factor and 10% maximum total harmonic distortion.

g. Speed control suitable for 100% to 10% operational capability.

h. Fully programmable and reviewable settings and parameters.

i. Suitable for operation at ambient conditions of 32 to 104 degrees F.

j. The power circuiting shall be separated from the low voltage control circuiting.

k. Output parameters where indicated:

1) Speed.

2) Trouble indication.

3) Overload indication.

4. Three phase motors rated 1 HP and greater shall be copper winding, re-lubable ball bearings, 1.15 service factor (1.0 service factor for inverter duty motors), premium efficiency, energy-saver type with a guaranteed NEMA nominal full-load efficiency, by IEEE Standard 112 Test Method "B". Efficiency rating shall appear on nameplate, and shall be not less than as follows; per NEMA MG 1 Part 12, Table 12-12, nominal minimum efficiencies:

MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	ODP MOTORS (RPM)			TEFC MOTORS (RPM)		
	1200	1800	3600	1200	1800	3600
1.0	82.5	85.5	77	82.5	85.5	77.0
1.5	86.5	86.5	84	87.5	86.5	84
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4

5. Nominal Motor Voltage Table:

Nominal System Voltage	Motor Nameplate
480V - 3 phase	460 volt
240V - 1 phase and 3 phase	230 volt
208V - 1 phase and 3 phase	200 volt
120V - 1 phase	115 volt

6. Motor Application; Provide the following enclosure types unless noted otherwise:

Environment/Location	Motor Enclosure Type
General Purpose	Open drip-proof, TEFC with cast iron frame, or encapsulated
Outdoors, below grade or high humidity	TEFC with cast iron frame
Hazardous	Explosion-proof

Environment/Location	Motor Enclosure Type
Packaged Refrigeration Compressors	Hermetic or semi-hermetic

7. Acceptable Manufacturers: Motors need not all be of the same manufacturer. Subject to the requirements of this section provide products by the following:

   a. General Electric Energy & Saver NEMA Premium Efficiency/(ODP); General Electric X$D Ultra NEMA Premium Efficiency (TEFC).

   b. Baldor-Reliance Super E.

   c. Marathon XRI.

PART 3 - EXECUTION

3.1 MOTORS

A. Furnished by equipment manufacturer and especially manufactured and/or selected, mounted, and installed for intended use. Install motors accessible for maintenance and belt adjustment.

END OF SECTION

SECTION 230519 - GAUGES AND THERMOMETERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

A. Submit product data for gauges, thermometers and thermowells.

PART 2 - PRODUCTS

2.1 WATER PRESSURE GAUGES

A. On devices such as pumps, strainers, coils, etc., where the differential pressure is the desired information, install only one pressure gauge with valved connections to the upstream and downstream taps. Include P/T test port in addition to the pressure gauge. Provide a second set of isolating valves at the gauge if gauge location is not within reach of tap points.

B. Bourdon tube type, 3-1/2 in. diameter minimum, dial face, non-repairable, stamped stainless steel case, acrylic lens, with snap-on rings. Silicon filled, phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip. 1/4 in. bottom connection. Accuracy, one (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener.

C. Make: Trerice, Weiss, Weksler.

2.2 PIPING SYSTEM THERMOMETERS

A. Industrial type, plastic or aluminum case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks where required; range as called for service. Universal, locking, adjustable type, 9 in. scale. For installation in hot water systems, graduations of 2°F., accurate to within 1°F. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F.

B. Make: Trerice, Weiss, Weksler.

2.3 THERMOWELL

A. All thermowells for steam service shall be stainless steel and for water service shall be brass. Thermowell length shall be in accordance with ISA Standards and shall include the appropriate extension to allow for pipe installation. Extension neck shall be included when required to match thermowell and insulation thickness.

B. Make: Trerice, Weiss, Weksler.

2.4 PRESSURE/TEMPERATURE TEST PLUGS

A. 1/4 in. NPT plug shall be capable of reading either a pressure or temperature. 1/8 in. o.d. dual seal core of Nordel 275°F with zero leakage from vacuum to 500 psig with dual seal core material as follows:

1. Hot water, Glycol - Nordel (EPDM) seat.

2. Chilled water, Cold water - Neoprene seat.

B. Test kit consisting of: one 2-1/2 in. test gauge 0-100 psi, one gauge adapter 1/8 in. probe, and two 5 in. stem pocket testing thermometers - one 0° to 220° and one 25° to 125°F.

C. Makes: Peterson Equipment Company, Sisco P/T plugs.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide where called for in the drawings and as noted below.

B. All gauges and thermometers shall be provided with pressure and temperature ranges appropriate for the system in which they are installed. Select to operate in the middle third of the range under normal operating conditions. Gauges and thermometers shall be suitable for the environment of their installed location, and if installed outdoors shall be acceptable for operation down to an ambient temperature of -20°F.

C. On devices such as pumps, strainers, coils, etc., where the differential pressure is the desired information, install only one pressure gauge with valved connections to the upstream and downstream taps. Provide P/T test port in addition to the pressure gauge. Provide a second set of isolating valves at the gauge if gauge location is not within reach of tap points.

3.2 WATER PRESSURE GAUGES

A. Provide gauge valve at each pressure gauge. Valve shall be 1/4 shut-off ball valve. Gauge cocks and needle valves are not allowed.

B. Heating water and chilled water coils: 0 to 60 psi range.

C. Provide 1/4 in. ball valve in each pump inlet and outlet tapping, or in piping adjacent to same. Range 30 in. vacuum to 100 psi.

D. Each water make-up valve assembly: 0 to 60 psi range.

3.3 THERMOMETERS

A. Provide thermowells mounted in oversize tee, or elbow if necessary, to provide as little restriction as possible to fluid flow. Provide thermometer stems and thermowell depths of proper length to allow accurate reading. All thermometers shall be secured to the well by tapered bushing and not set screws. Locate adjacent to control sensing equipment. Install and adjust angles so as to be easily read from floor.

B. Chilled Water Entrance: Supply and return; range 20° to 120°F.

C. Cooling Coil: Inlet and Outlet; Range 20° to 120°F.

D. Heating Coil: Inlet and Outlets; Range 0° to 220° F.

3.4 TEST PLUG

A. Provide test plugs at locations as called for. In addition, test plugs shall be provided on each coil bank, heat exchanger, fan coil and at all permanent pressure gauge location.

B. Deliver test kit to Owner and obtain receipt.

C. Provide a minimum of twenty (20) test plugs to be installed at location(s) identified by Cx Agent. Contractor shall request locations prior to filling the system(s).

END OF SECTION

SECTION 230523 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation and related Work designed in Contract Documents.

1.2 SUBMITTAL

A. Submit product data for valves and accessories.

PART 2 – PRODUCTS

2.1 GENERAL

A. Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.

2. Manufacturer valve tag identifying the valve type and major component materials.

3. Stem packing serviceable without removing valve from line.

4. Valves on insulated services shall have handle extensions so that the handle is fully beyond the insulation jacketing.

5. Where possible, all valves of like type shall be of a single manufacturer.

6. Unless otherwise noted, all valves for shut-off and bypass service shall be as follows:

   a. NPS 2 in. and below: Ball valve with thread, sweat, or socket weld connections. All lead free bronze valves shall have threaded connections.

   b. NPS 2-1/2 in. and above: Butterfly valves with flanged/lugged connections.

   c. NPS 2-1/2 in. and 3 in. copper piping systems: Ball valves with sweat or threaded connections.

7. All valves for all services shall be fully bi-directional and suitable for dead end service.

8. Insulated valves shall have extended handle stems.

9. On all valves the packing compression is to be independent of the stem, ball or handle systems. All valve stems are to be blowout proof. Packing shall be accessible without disturbing the insulation.

10. Combination devices and pre-piped manufacturer coil fit out kits are not permitted, including but not limited to the following:

    a. Manual balance, control, ball isolation valves

    b. Manual balance, strainer, ball isolation valves (TDV)

    c. Y-strainer, ball isolation valves

    d. Ball isolation, drain valves

    e. Balancing, shutoff valves

B. Acceptable Manufacturers:

1. Ball Valves: See below for acceptable manufacturers and models.

2. Butterfly Valves: See below for acceptable manufacturers and models.

3. Check Valves: Apollo, Hammond, Milwaukee, Nibco, Watts.

2.2 BALL VALVES

A. General Duty

1. For all water services and all other normal non-corrosive services, ball valves shall be as follows:

a.	Body	Bronze or Lead-Free Bronze
b.	Body Style	Full Port, Two piece
c.	Trim	316 Stainless Steel Ball and Stem
d.	Seat	Reinforced Teflon (RTFE), 15% glass filled double seal
e.	WOG Rating	300 psig Minimum
f.	Saturated Steam Rating	150 psig Minimum
g.	Actuator	Lever handle

2. Acceptable Models:

a.	Apollo	70-140, 70-240, 77CLF-140

b.	Nibco	T-585-70-66, S-585-70-66, T-585HP-66-LF
c.	Watts	LFB6080-G2-SS

B. Hose Connection

1. 1/2 in. and 3/4 in. hose connection ball valve shall be as:

a.	Body	Lead Free Bronze
b.	Body Style	Full Port, Two piece
c.	Trim	316 Stainless Steel Ball and Stem
d.	Seat	PTFE or TFE
e.	Seat Working P/T Rating	300 psig @ 250°F Minimum
f.	WOG Rating	300 psig Minimum
g.	SWP Rating	150 psig Minimum

2. Acceptable Models:

a.	Apollo	70LF-140-HC
b.	Nibco	T-585-66-LF-HC

2.3 BUTTERFLY VALVES

A. General Duty

1. For all water services and all other normal, non-corrosive services, butterfly valves shall be single offset as follows:

a.	Body	Ductile Iron or Cast Iron
b.	Body Style	Fully Lugged
c.	Trim	316 or 17-4 pH Stainless Steel
d.	Disc	Stainless Steel
e.	Seat	EPDM
f.	Seat Working P/T Rating	150 psig @ 250°F Minimum
g.	Body Working P/T Rating	ANSI 150 Minimum

		h. Actuator	Under 4 in. – Locking Lever Handle 4 in. and above – Handwheel Gear Operator

2. Acceptable Models:

a.	Keystone	Series 60
b.	Nibco	LD-3022
c.	Watts	BF-03

2.3 CHECK VALVES

A. 2 in. and Smaller: Bronze, swing check, threaded or soldered ends, 125 SWP, Milwaukee 1509.

B. 2-1/2 in. and Larger: Cast iron body, 304 stainless steel seat, disc, spring, bushing and screw, 125 lb. SWP. Milwaukee 1400. Double disc or bi-folding disc type valves are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Provide valves of type called for and where required to service equipment.

2. Provide at major building and systems sections.

3. Provide chain wheels, guides, and chain loops for valves, where called for or in Mechanical Rooms where valves are mounted higher than 8’-0” AFF.

4. Isolating valves for individual fan convectors, room units, terminal units, or other similar apparatus may be inside cabinet or at connection to branch mains where accessible.

5. Locate valves with handles at horizontal position when 5 feet or more above the floor, for greater visibility. Otherwise, locate valves with handles at or above horizontal position. Swing check valves in upright position only.

6. Provide hose threaded valves at low points, strainers, equipment, and as called for.

7. Install valves after welding adjacent to valve is complete to protect seat and disk.

8. The use of the following is not allowed:

a. Dielectric unions

b. Triple duty valves

c. Automatic flow control valves

9. Provide ball valves for shut-off on all pressure gauges at the gauge and separate 1/2" (one half inch) ball valves for the various taps to the gauge on a manifold gauge.

10. On chilled water and glycol service use manual vents only. Do not use automatic vent valves.

END OF SECTION

SECTION 230548 - VIBRATION ISOLATION OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.2 RELATED SECTIONS

A. See Specification Section 230550 - Wind Restraint for Mechanical Systems.

1.3 MATERIAL AND EQUIPMENT

A. All vibration isolation mounts shall be supplied by one of the following approved manufacturers:

1.	Mason Industries Inc. (Hauppauge, NY)	M.I.
2.	Kinetics Noise Control Inc. (Dublin, OH)	K.N.C.
3.	Vibration Mountings & Controls Group. (Butler, NJ)	VMC Group
4.	Vibration Eliminator Co. (Long Island City, NY)	V.E.C.

1.4 QUALITY ASSURANCE

A. Coordinate the size, location and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.

C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein even if not expressly specified or shown on the Drawings, without claim for additional payment.

D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specification.

E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for re-balancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

F. Upon completion of work, the Architect or the Architect's Representative shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.

1.5 SUBMITTALS

A. Refer to related sections elsewhere for procedural instruction for submittals.

B. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be completed when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.

C. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.

D. Detailed selection data for each vibration isolator supporting equipment, including:

1. The equipment identification mark.

2. The isolator type.

3. The actual load.

4. The static deflection expected under the actual load.

5. The specified minimum static deflection.

6. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.

7. Special details necessary to convey complete understanding of the work to be performed.

E. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job if requested. All costs associated with submission of samples shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

A. General:

1. All springs installed out-of-doors shall be zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.

2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.

3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.

4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the Drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type FSN (Floor Spring and Neoprene):

1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, grommets shall be provided for each bolt hole in the base plate. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NO isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, beating plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

2. Type FSN isolators shall be one of the following products with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

a.	Type SLF	M.I.
b.	Type FDS	K.N.C.
c.	Series A	VMC Group

C. Type FSNTL (Floor Spring and Neoprene Travel Limited):

1. Spring isolators shall be freestanding and laterally stable. Spring diameter shall not be less than 0.8 of the compression height of the spring at the rated load. Spring shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one (1). All mounts shall have leveling bolts. All mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4 in. shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.

2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is use, grommets shall be provided for each bolt hole in the base plate.

3. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

4. Type FSNTL isolators shall be one of the following products, with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

a.	Type SLR	M.I.
b.	Type FLS	K.N.C.
c.	Series AWR	VMC Group

D. Type FN (Floor Neoprene):

1. Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.

2. Type FN isolators shall be one of the following products or approved equal:

a.	Type ND	M.I.

b. Type RD K.N.C.

c. Series RD VMC Group

E. Type NP (Neoprene Pad):

1. Neoprene pad isolators shall be one layer of 1/4 in. to 3/8 in. thick ribbed or waffled neoprene. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

2. Type NP isolators shall be one of the following products or approved equal:

a. Type W M.I.

b. Type NPS K.N.C.

c. Series Shear Flex VMC Group

F. Type HSN (Hanger Spring and Neoprene):

1. Vibration isolator hangers shall consist of a free standing and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and hanger housing lower hole size shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the housing. Alternatively, other provisions shall be made to allow for a 30° arc of movement of the bottom hanger rod without contacting the isolator housing. Spring diameter shall not be less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3 in. minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.

2. Type HSN isolators shall be one of the following products or approved equal:

a. Type 30N M.I.

b. Type SRH or SFH K.N.C.

c. Type RSH or RFH VMC Group

G. Type HN (Hanger Neoprene):

1. Vibration isolator hangers shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck brushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing.

2. Type HN isolators shall be one of the following products or approved equal:

a.	Type HD	M.I.
b.	Type RH or FH	K.N.C.
c.	Type RHD or RFD	VMC Group

2.2 EQUIPMENT BASES

A. Type BIB (Base-Inertia Base):

1. Concrete inertia bases shall be formed of stone-aggregate concrete (150 lb./cu. ft.) and appropriate steel reinforcing cast between welded or bolted perimeter structural steel channels. Inertia bases shall be built to form a rigid base that will not twist, rack, deform, deflect, or crack in any manner that would negatively affect the operation of the supported equipment or the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the inertia base and not less than 6 in. The base footprint shall be large enough to provide stability for supported equipment. Inertia bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

2. The steel frame and reinforcement shall be supplied by the vibration isolator manufacturer.

3. Frame and reinforcement for Type BIB bases shall be one of the following products or approved equal:

a.	Type KSL	M.I.
b.	Type CIB-L or CIB-H	K.N.C.
c.	Series WPF	VMC Group

2.3 RESILIENT PENETRATION SLEEVE/SEAL

A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is 1/2 in. to 3/4 in. larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend 1 in. beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4 in. of the ends of the sleeve. The remaining 1/4 in. space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve.

2.4 RESILIENT LATERAL SUPPORTS

A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN that are specifically designed to provide resilient lateral bracing of ducts or pipe.

B. Resilient lateral supports shall be one of the following products or approved equal:

1.	Type ADA	M.I.
2.	Type RGN	K.N.C.
3.	Type MDPA	VMC Group

2.5 FLEXIBLE DUCT CONNECTIONS

A. Flexible duct connections shall be heavy glass fabric, double neoprene coated, approximately 30 oz. per sq. yd. The clear space between connected parts shall be a minimum of 3 in. and the connection shall have a minimum of 1.5 in. of slack material. Materials for flex connection shall be fire retardant, water and milder resistant, and comply with UL standard 214.

B. Flexible duct connections shall be one of the following products or approved equal:

1. Ventfabrics, Inc. "Ventglass".

2.6 FLEXIBLE PIPE AND PUMP CONNECTIONS (BRAIDED STAINLESS STEEL)

A. Braided stainless steel pump and pipe connector(s) shall be constructed of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s) and a stainless steel ring-ferrule/band (material gauge not less than .048 in.) shall be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. Fittings shall be attached using a 100% circumferential TIG weld.

B. Braided stainless steel pump and pipe connector(s) must be suitable for operating temperatures up to 850°F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor.

C. Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

D. Braided stainless steel connectors shall carry a three (3) year warranty when installed in accordance with all specifications and installation instructions as described by the manufacturer.

E. End fittings shall be flat-faceplate steel flanges with 150# ANSI drilling, and outside diameter, carbon steel MPT ends, flanged by Schedule 40 grooved ends or increasing ends.

F. Acceptable Manufacturers: Flexhose Pumpsaver or equivalent Keflex, Metraflex, Mason-Mercer.

2.7 THRUST RESTRAINTS

A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be pre-compressed at the factory to allow for a maximum of 1/4 in. movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods.

B. Thrust restraints shall be one of the following products or an approved equal:

1.	Type WB	M.I.
2.	Type HSR	K.N.C.
3.	Type HTR	VMC Group

2.8 GROMMETS

A. Grommets shall be specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range.

B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an approved equal:

1.	Type Isogrommets	MBIS, Inc. (Bedford Heights, OH)
2.	Type WB	Barry Controls (Brighton, MA)
3.	Type HG	Mason Industries Inc., (Hauppauge, NY)

2.9 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

1.	Acoustical sealant	D.A.P.
2.	BR-96	Pecora
3.	Acoustical sealant	Tremco

4. Acoustical sealant U.S.G.

PART 3 - EXECUTION

3.1 APPLICATION

A. General:

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the Drawings or specified herein.

2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment:

1. Unless otherwise shown or specified on Drawings, all floor-mounted major equipment shall be set on concrete housekeeping pads.

2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as specified hereunder.

3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the Drawings.

4. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.

5. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4 in. or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Equipment Vibration Isolation Schedule:

TYPE	VIBRATION ISOLATOR TYPE	MINIMUM STATIC DEFLECTION (In.)	EQUIPMENT BASE
Air Handling Units (Note 1)	FSN	2.5	----
Base Mounted Pumps	FSN	.75	BIB
Inline Pumps	HSN	.75	----
Roof Fans (Note 1)	FSNTL	1.0	----
Ceiling Fans (Note 1)	HSN	1.5	----
Ceiling Fan Coil Units (Note 1)	HN	.30	----
Wall Mounted Fan Coil Units (Note 1)	NP	.30	----

NOTE 1 Equipment base and vibration isolators can be deleted where air handlers are equipped with factory installed internal isolators.

D. Miscellaneous Mechanical Equipment:

1. Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks and expansion tanks which are connected to isolated piping systems shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for .01 in. static deflection) unless their position in the piping system requires a higher degree of isolation as called for under "Pipe Isolation".

E. Pipes:

1. All chilled water and hot water piping shall be isolated from the building structure within the following limits:

a. Within mechanical rooms.

b. Within 50 ft. total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.).

c. Everywhere for piping that is 5 in. or larger.

d. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.

e. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2 in., Type FSN or Type HSN isolators shall be used. When the required static deflection is less than or equal to 1/2 in., Type FN or Type HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or Type HN achieving at least 1/4 in. static deflection.

f. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.

g. Pipes penetrating the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3.2 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General:

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.

2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators:

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.

4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.

5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beams and joists. Provide suitable intermediate support members as necessary.

6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.

7. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and un-isolated pipes on the same trapeze.

8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.

9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.

10. The installed and operating heights of equipment vibration-isolated with Type FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4 in. clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases:

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitable rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements, and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

2. Unless otherwise indicated, there is to be a minimum operating clearance of 1 in. between steel rails, steel frame base or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Flexible Duct Connections:

1. Sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so that the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections:

1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.

F. Thrust Restraints:

1. Thrust restraints shall be attached on each side of the fan at the vertical centerline of thrust. The two rods of the thrust restraints shall be parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets:

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals:

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION

SECTION 230550 - WIND RESTRAINT FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Support and brace mechanical and electrical systems, as called for, to resist directional wind forces (lateral, longitudinal and vertical).

1.2 APPLICABLE CODES AND STANDARDS

A. Provide work in compliance with the following Codes and Standards based on the current edition in effect at project location:

1. Building Code of New York State (Section 1609 and 1613).

2. Existing Building Code of New York State

3. Mechanical Code of New York State (Section 301, Item 301.15).

4. American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures with Supplement No. 1 - Standard ASCE/SEI 7-16.

1.3 QUALITY ASSURANCE

A. General:

1. The contractor shall provide Professional Engineer stamped and signed engineering calculations and details of wind restraint systems to meet total design lateral force requirements for support and restraint of mechanical systems. Engineer shall be licensed to practice in the state in which the project is located.

2. The wind restraint engineering calculations and details shall provide the quantity of attachments and size/type of attachments for the mounting of an equipment curb or support rail to the building structure, and for attachment of the equipment or system to the equipment curb or support rail. It is not the intent for manufactured equipment curbs or support rails to be certified by their respective manufacturers, nor is it the intent for them to be certified by the Professional Engineer who is providing the wind restraint calculations and connection methodology.

3. Systems requiring wind restraint including, but not limited to:

a. Exhaust fans.
b. Roof curbs and equipment supports associated with any of the equipment listed above.
c. Intake Louvers.

1.4 SUBMITTALS

A. Submit wind force level (Fp) calculations from applicable building code. Submit pre-approved restraint selections, installation details, and plans indicating locations of restraints.

B. Calculations, plans, restraint selection, and installation details shall be stamped and signed by a professionally licensed engineer experienced in wind restraint design.

C. Submit manufacturer's product data.

D. For each piece of equipment that requires wind restraint as outlined in this section, include the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchoring provisions.

2. Anchorage: Provide detailed description of equipment anchorage devices on which the calculations are based and their installation requirements. Identify anchor bolts, studs and other mounting devices. Provide information on the size, type and spacing of mounting brackets, holes and other provisions.

E. The Contractor shall provide photographs of the installed roof mounted equipment, showing the fully installed wind restraint anchoring, prior to the roofing material installation, as a formal submittal for verification that the work has been completed.

PART 2 - PRODUCTS

2.1 CODE INFORMATION

A. This project is subject to the wind bracing requirements of the codes listed above. The following criteria are applicable to this project:

1. Ultimate Design Wind Speed (V): 110 mph

2. Risk Category: II

3. Exposure Category: C

4. Ground Elevation Factor (Ke): 0.97

5. Topographic Factor (Kzt): 1.0

6. Wind Directionality Factor (Kd): 0.85

7. Combined Gust Factor for Rooftop Equipment (GCr): Per Section 29.4.1 of ASCE 7-2016, based on dimensions of individual rooftop equipment considered.

8. Height and Exposure Adjustment Coefficient (λ): 1.35

2.2 WIND BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Design analysis shall include calculated dead loads, wind loads, and capacity of materials utilized for the connection of the equipment or system to the structure.

2. Analysis shall detail anchoring methods, fastener sizes and spacing, etc.

3. All wind restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 2.1.

B. Friction from gravity loads shall not be considered resistance to wind forces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wind Restraint of Piping:

1. All restraint systems shall be installed in strict accordance with the wind restraint design submittal.

2. Installation of restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

B. Wind Restraint of Ductwork and Equipment:

1. All restraint systems shall be installed in strict accordance with the wind restraint design submittal.

2. The interaction between mechanical and electrical equipment and the supporting structures shall be designed into the restraint systems.

3. Installation of restraints shall not cause any change in position of equipment or ductwork, resulting in stresses or misalignment.

4. Exhaust fans with hinge kits shall have wind restraint fasteners installed on the hinged side, same as the three (3) non-hinged sides.

5. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

6. Do not install any equipment or duct that makes rigid connections with the building unless isolation is not specified.

7. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

3.2 INSPECTION

A. The engineer who performs the delegated design for wind restraint shall inspect photos provided by the installing contractor to verify that the installation is in accordance with their design and applicable codes. The delegated design engineer shall coordinate with the contractor(s) who have installed the work.

B. Upon final acceptance by the delegated design engineer of all work performed by the contractor(s), the delegated design engineer shall submit a letter to the Owner's Representative indicating that the installation of restraints complies with the requirements of their design and applicable codes.

END OF SECTION

SECTION 230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATION

A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors and viewing angles.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device.

B. Submit valve schedule for each piping system indicating valve number, location, and valve function.

C. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

D. Submit system schematic diagram with location of valve and associated valve number.

1.4 MAKES

A. Allen Systems, Inc.; Brady (W.H.) Co.; Signmark Div.; Industrial Safety Supply Co., Inc.; Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where this is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

C. For work within an existing building, the mechanical identification shall meet the intent of this section, but match the Owner's existing identification symbology.

2.2 PIPING IDENTIFICATION

A. Identification Types:

1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

B. Colors:

Fluid Service	Colors & Letters Description
Potable, Cooling, Boiler Feed, Other Water	GREEN (White Letters)

C. Lettering:

1. Refer to HVAC symbols list for associated pipe function and labeling identification.

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high numerals. Identify between heating and plumbing services with 1/4 in. letters above the valve number. Lettering to be stamped and in-filled black. Seton, or equal.

a. Valve-tag Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Chart:

1. Provide valve chart for all valves tagged as a part of this project. Frame and place under clear glass. Hang in Mechanical Room.

2. Valve chart to include as a minimum, valve #, valve size, valve type, valve service description, valve location.

2.4 EQUIPMENT LABELS

A. Metal Labels for Equipment (Indoors and Outdoors):

1. Material and Thickness: Brass, 0.032 in. minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 in. by 3/4 in.

3. Minimum Letter Size: 1/4 in. for name of units if viewing distance is less than 24 in., 1/2 in. for viewing distances up to 72 in. and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment Indoors:

1. Material and Thickness: Multilayer, multicolor, phenolic (micarta) labels for mechanical engraving, 1/8 in. thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 in. by 3/4 in.

6. Minimum Letter Size: 1/4 in. for name of units if viewing distance is less than 24 in., 1/2 in. for viewing distances up to 72 in., and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 in. x 11 in. bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

E. Provide for the following equipment:

1. Fans

2. Air Handling Unit

3. Heat exchangers

4. Pumps

5. Fan Coil Units

6. Air Terminal Unit / Air Valves

7. Unit Heater / Cabinet Unit Heater

2.5 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid. Color coded. Provide for the following:

1. Fire dampers/smoke dampers - RED

2. Plumbing valves - BLUE

3. HVAC valves - ORANGE

4. Air Valves, VAV boxes or reheat coils - GREEN

5. Fans - YELLOW

6. Pumps - BLACK

PART 3 - EXECUTION

3.1 GENERAL

A. Provide piping identification with directional flow arrows for all piping on project, at maximum intervals of 20 feet.

1. For piping installed through floors or walls, provide at least one pipe label on each side of penetration, for each pipe function.

2. For piping adjacent to 3-way diverting/mixing valves and tee/wye branches, provide at least one pipe label on each side of valve/tee.

3. Label all abandoned piping if abandoned piping is allowed by Owner/Engineer. Document locations of all abandoned piping on as-builts.

4. Label piping after painting of piping is complete.

B. Provide valve tags for all valves provided on project, except for service valves at terminal equipment.

C. Provide equipment tags for all equipment listed above.

D. Provide above ceiling equipment locator stickers on ceiling grid for all equipment listed above.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

B. This Section specifies the requirements and procedures of mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

C. Test, adjust, and balance the following mechanical systems:

1. Airside

    a. Supply air systems, all pressure ranges; including constant volume and variable volume systems.

    b. Return air systems.

    c. Exhaust air systems

2. Hydronics

    a. Constant flow systems.

    b. Variable flow systems.

3. Laboratory Fume Hoods.

D. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes;

2. Specifications for materials for patching mechanical systems;

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.2 SUBMITTALS

A. Provide information in report form listing items required by specifications. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner’s Representative.

B. Strategies and Procedures Plan: Within thirty (30) days of Contractor's Notice to Proceed, submit testing and balancing strategies and step-by-step procedures as specified in Section 3.1.B, "Preparation", and consistent with those listed in Part 3 of this specification.

C. System Readiness Checklists: Within thirty (30) days of Contractor's Notice to Proceed, AABC agency shall provide system readiness checklists as specified in Section 3.1.C, "Preparation", to be used and filled out by the installing contractors verifying that systems are ready for Testing and Balancing.

D. Examination Report: Provide a summary report of the examination review required in Section 3.1.D to the Engineer, documenting issues that may preclude the proper testing and balancing of the systems.

E. Certified report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

2. Individual test sheets for air handlers, terminal units, air distribution, exhaust fans, duct traverses, pumps, air handling coils, reheat coils, radiation, convectors, cabinet unit heaters and unit ventilators.

3. Manufacturer's pump and fan curves for equipment installed with design and actual operating conditions indicated.

4. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TABB's "Testing, Adjusting and Balancing Bureau".

1.3 DEFINITIONS

A. System testing, adjusting and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air and water distribution;

2. Adjustment of total system to provide design quantities;

3. Electrical measurement;

4. Verification of performance of all equipment and automatic controls.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. This data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return supply or outside air inlets or outlets on terminals such as registers, grilles, diffusers, and louvers.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch Main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.4 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) or Testing, Adjusting and Balancing Bureau (TABB).

2. Individual manufacturer requirements and recommendations.

B. Maintain qualified personnel at project for system operation and trouble shooting. TAB contractor shall change sheaves and perform mechanical adjustments in conjunction with balancing procedure.

C. Balancing contractor shall be current member of AABC, NEBB, or TABB.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the *AABC National Standards for Total System Balance and SMACNA TAB Procedural Guide.*

1.5 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balance facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.

2. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

3. All outdoor conditions (Db, Wb, and a description of the weather conditions) at the time of testing shall be documented in the report.

4. Airside

a. Prior to balancing, adjust balancing devices for full flow and replace temporary filters.

b. Provide sheaves and belts as required to meet system performance requirements for all belt-driven fan motors 10 HP and greater. Adjust and align sheaves to obtain proper settings and operation. Verify motors are not overloading.

c. Installing contractor shall replace dampers in new systems and identify dampers in existing systems that cannot be manipulated to satisfy balancing requirements.

d. Traverse main ducts to determine total system air quantities after all outlets have been set prior to final adjustment if the system does not meet design requirements. A sum of room CFM's is not acceptable.

e. If duct construction and/or installation prohibits proper traverse readings, provide coil measurements at main coils and/or fresh air intake traverse with units operating in 100% outside air mode (where applicable).

5. Hydronics

a. Prior to balancing, adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

b. Installing contractor shall replace balancing cocks and flow balancers in new systems and identify flow balancers and balancing cocks in existing systems that cannot be manipulated to satisfy balancing requirements.

1.6 CONTRACTOR RESPONSIBILITIES

A. Provide Testing and Balancing agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats.

B. Controls contractor shall provide required BAS hardware, software, personnel and assistance to Testing and Balancing agency as required to balance the systems. Controls Contractor shall also provide trending report to demonstrate that systems are complete.

C. Coordinate meetings and assistance from suppliers and contractors as required by Testing and Balancing agency.

D. Installing contractor shall replace or repair insulation as required by Testing and Balancing agency.

E. Have the HVAC systems at complete operational readiness for Testing and Balancing to begin. As a minimum verify the following:

1. Airside:

a. Provide additional dampers, sheaves and belts as required by Testing and Balancing agency.

b. Flag all manual volume dampers with fluorescent or other high-visibility tape.

c. Provide access to all dampers, test ports, nameplates and other appurtenances as required by Testing and Balancing agency.

d. All ductwork is complete with all terminals installed.

e. All volume, smoke and fire dampers are open and functional.

f. Clean filters are installed.

g. All fans are operating, free of vibration, and rotating in correct direction.

h. ASD start-up is complete and all safeties are verified.

i. System readiness checklists are completed and returned to Testing and Balancing agency.

2. Hydronics:

a. Provide additional valves as required by Testing and Balancing agency.

b. Provide access to all valves, test ports, nameplates and other appurtenances as required by Testing and Balancing agency.

c. Piping is complete with all terminals installed.

d. Water treatment is complete.

e. Systems are flushed, filled and air purged.

f. Strainers are pulled and cleaned.

g. Control valves are functioning per the sequence of operation.

h. All shutoff and balance valves have been verified to be 100% open.

i. Pumps are started, and proper rotation is verified.

j. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.

k. ASD start-up is complete and all safeties have been verified.

l. System readiness checklists are completed and returned to Testing and Balancing agency.

F. Promptly correct deficiencies identified during Testing and Balancing.

G. Maintain a construction schedule that allows the Testing and Balancing agency to complete work prior to occupancy.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, Pitot tubes, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required.

B. Instrumentation Calibration: Calibrate instruments at least every six (6) months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine Bid Documents and submittals and notify Owner's Representative and Engineer of any questions regarding balancing.

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper Testing and Balancing of systems and equipment.

2. Examine the approved submittals for HVAC systems and equipment.

3. Examine equipment performance data including fan and pump curves.

B. Prepare a Testing and Balancing Strategies and Procedures Plan that includes:

1. Equipment and systems to be tested.

2. Strategies and step-by-step procedures for balancing the systems.

3. Instrumentation to be used.

4. Sample forms with specific identification for all equipment.

C. Prepare system-readiness checklists, as described in the *AABC National Standards for Total System Balance and SMACNA TAB Procedural Guide*, for use by contractors in verifying system readiness for Testing and Balancing. These shall include, at a minimum:

1. Airside:

a. All ductwork is complete with all terminals installed.

b. All volume, smoke and fire dampers are open and functional.

c. Clean filters are installed.

d. All fans are operating, free of vibration, and rotating in correct direction.

e. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.

f. Automatic temperature-control systems are operational.

g. Ceilings are installed.

h. Windows and doors are installed.

i. Suitable access to balancing devices and equipment is provided.

j. Equipment and duct access doors are securely closed.

2. Hydronics:

a. Piping is complete with all terminals installed.

b. Water treatment is complete.

c. Systems are flushed, filled and air purged.

d. Strainers are pulled and cleaned.

e. Control valves are functioning per the sequence of operation.

f. All shutoff and balance valves have been verified to be 100% open.

g. Pumps are started and proper rotation is verified.

h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.

i. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.

j. Suitable access to balancing devices and equipment is provided.

D. Examine construction and notify Owner's Representative and Engineer of outstanding issues related to balancing, as part of "Examination Report" submittal.

1. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.

2. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor and functioning.

3. Airside

a. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.

b. Examine systems for installed balancing devices, such as test ports, gage cocks, flow-control devices, and manual volume dampers prior to pressure testing. Note the locations of devices that are not accessible for testing and balancing.

4. Hydronics

a. Examine strainers to verify that Mechanical Contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.

b. Examine two-way valves for proper installation and function.

c. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

d. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

e. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

f. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings and weld-o-lets prior to pressure testing. Note the locations of devices that are not accessible for testing and balancing.

3.2 TESTING OF EXISTING WATER SYSTEMS

A. Hydronics: Prior to performing any demolition work, Testing and Balancing Contractor shall provide the following:

1. Flow and inlet/outlet pressure readings at pump hot water HWP-9 and HWP-10 located in Wing Hall Mechanical Room.

2. Flow and inlet/outlet pressure readings at reheat hot water heat exchanger HX-5 and HX-6 located in Wing Hall Mechanical Room.

B. Testing and Balancing Contractor shall submit results and any deficiencies to Engineer in writing per the requirements of this specification. No demolition work shall be performed prior to written Engineer review of existing airflow conditions.

3.3 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, water flow, and TDH of each pump.

2. Measure motor voltage and amperage. Compare the values to motor nameplate information.

3. Check bearings and other lubricated parts for proper lubrication.

4. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. Bearings and other parts are properly lubricated.

2. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

D. Hydronics: Prior to performing any demolition work, Testing and Balancing Contractor shall provide the following:

1. Flow and inlet/outlet pressure readings at pump hot water HWP-9 and HWP-10 located in Wing Hall Mechanical Room.

2. Flow and inlet/outlet pressure readings at reheat hot water heat exchanger HX-5 and HX-6 located in Wing Hall Mechanical Room.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TABB's “SMACNA TAB Procedural Guide” and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.6 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and function.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.7 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to sheaves sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.8 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return-and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the conditions but leave outlets balanced for maximum airflow.

6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that the adequate static pressure is maintained at the most critical unit.

8. Record the final fan performance data.

3.9 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Cross check the summation of required coil and heat exchanger gpms with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:

1. Check liquid level in expansion tank and verify that tank is set to specified pressure for system fill and expansion.

2. Check that makeup water has adequate pressure to highest vent.

3. Check that control valves are in their proper positions.

4. Check that air has been purged from the system.

5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

6. Verify that motor starters are equipped with properly sized thermal protection.

3.10 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.

b. Measure flow by main flow meter, if installed.

c. If main flow meter is not installed, determine flow by pump total dynamic head (TDH) or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves or fittings.

b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.

c. Convert pressure to head and correct for differences in gauge heights.

d. On single stage centrifugal pumps, verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

e. With all valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.

2. Adjust main and branch balance valves for design flow.

3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow measuring devices installed at terminals for each space to design water flows.

1. Measure flow at all terminals.

2. Adjust each terminal to design flow.

3. Re-measure each terminal after all have been adjusted.

4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.

5. Perform temperature tests after all flows have been balanced.

D. For systems with pressure-independent valves at the terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.

2. Perform temperature tests after all flows have been verified.

E. For systems without pressure-independent valves or flow measuring devices at the terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.

2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.

2. Re-measure all final pump operating data, TDH, volts, amps, static profile.

3. Mark all final settings.

G. Verify that all memory stops have been set.

3.11 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential pressure (DP) sensor is located per the Contract Documents.

2. Determine if there is diversity in the system.

B. For systems with no diversity:

1. Follow procedures outlined for constant-flow hydronic systems.

2. Prior to verifying final system conditions, determine the system DP setpoint.

3. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.

4. Mark all final settings and verify that all memory stops have been set.

C. For systems with diversity:

1. Determine diversity factor.

2. Simulate system diversity by closing required number of control valves, as approved by the design Engineer.

3. Follow procedures outlined for constant flow hydronic systems.

4. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance the terminals that were just opened.

5. Prior to verifying final system conditions, determine the system DP setpoint.

6. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.

7. Mark all final settings and verify that all memory stops have been set.

D. For systems with pressure-independent valves at the terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.

2. Perform temperature tests after all flows have been verified.

3.12 PROCEDURES FOR LABORATORY FUME HOODS

A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate make-up air is available to achieve the indicated flow of the hood.

B. Measure, adjust and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.

1. For laboratory fume hoods installed in variable exhaust systems, measure adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.

2. For laboratory fume hoods designed with integral make-up air, measure, adjust, and record the exhaust and make-up airflow.

C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.

D. After balancing is complete, do the following on all new fume hoods:

1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.

2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 in. between points and between any point and the perimeter of the opening.

a. Representatives from Cornell EHS and the BACS Contractor shall be present to participate and witness fume hood face velocity testing as well as ASHRAE Standard 110 tracer gas capture tests. Having these parties represented during testing will streamline final certification efforts; deficiencies can be discussed at the time of testing, the potential for operation at lower face velocities can be authorized and BACS set points can be finalized – all of which will avoid multiple trips during project close-out.

b. For laboratory fume hoods designed with combination sashes, measure the face velocity for the both the vertical and horizontal sash position.

c. For laboratory fume hoods designed to vary the face velocity at based on occupancy, measure and record the face velocity for all modes of operation.

d. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.

e. Calculate and report the average face velocity by averaging all velocity measurements.

f. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.

g. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

E. Testing Contractor to provide a complete report of the results of the testing program including an executive summary, an outline of the test procedures and equipment used, a table of the results of each test conducted on each hood and a conclusion and recommendation section discussing the results and (if necessary) recommendations to improve fume hood performance.

3.13 ROOM DIFFERENTIAL PRESSURE TESTING

A. Upon completion of airflow balancing of all supply, return and exhaust registers (within specified tolerances), test and record differential pressures between spaces identified in Construction Documents.

B. Adjust volume dampers and/or control set points as required to achieve specified pressure differential. Immediately notify engineer if airflow settings are adjusted beyond tolerances specified in this section to ensure that air change rates or other less apparent considerations have been taken into account.

C. Test and record final differential pressure values and adjusted airflows. Clearly indicate positive or negative pressure differential in relation to which adjacent space as there may be multiple adjacent spaces measurements are required for.

3.14 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Airside

a. Supply, Return, and Exhaust Fans: Zero to plus 5 percent.

b. Air Outlets and Inlets: Plus or minus 5 percent.

c. Minimum Outside Air: Zero to plus 5 percent.

d. Fume Hood Exhaust Airflow and Face Velocity: Plus or minus 5 percent.

e. Fume Hood Face Velocity Range: 0 to 15 fpm between the high / low velocity readings.

f. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

2. Hydronics

a. Heating-Water Flow Rate: Plus or minus 10 percent.

b. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.15 FINAL TEST & BALANCE REPORT

3.16 FINAL TEST AND BALANCE REPORT

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the Testing and Balancing process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the technicians or Test and Balance Engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:

a. AABC or NEBB Certified Company Name.

b. Company Address.

c. Company Telephone Number.

d. Project Identification Number.

e. Location.

f. Project Architect.

g. Project Engineer.

h. Project Contractor.

i. Project Number.

j. Date of Report.

k. Certification Statement.

l. Name, Signature, and Certification Number.

2. Table of Contents.

3. National Performance Guaranty.

4. Report Summary:

   a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.

5. Instrument List:

   a. Type
   b. Manufacturer
   c. Model
   d. Serial Number
   e. Calibration Date

C. Required Airside data - Test, adjust and record the following:

1. Motors:

   a. RPM
   b. BHP
   c. Full load amps
   d. Sheave sizes, number and size of belts
   e. Shaft diameter
   f. Complete nameplate data

2. Fans:

   a. Cfm
   b. RPM
   c. Suction static pressure
   d. Discharge static pressure
   e. Sheave sizes, number and size of belts, key sizes, shaft, diameter
   f. Complete nameplate data
   g. Sketch of system's inlet and outlet connections
   h. Location of test port

3. Duct: Traverse Zones

   a. Cfm
   b. Static Pressure

4. AHU: Air Handling Units, Fan Coil Units

   a. Minimum outdoor air Cfm
   b. Total discharge and return Cfm
   c. Static profile thru unit
   d. Complete nameplate data

5. Coil:

    a. Entering air temperature (DB/WB)
    b. Leaving air temperature (DB/WB)
    c. Static differential
    d. Face velocity and area
    e. Cfm
    f. Complete nameplate data

6. VAV Boxes and Lab Air Valves:

    a. Minimum Cfm
    b. Maximum Cfm

7. Registers/Grilles/Diffusers:

    a. Cfm
    b. Set, adjust and record air flow pattern

8. Filter Banks:

    a. Nameplate data
    b. Static pressure drop

9. Cabinet Unit Heaters:

    a. Cfm

D. Required Fluid Data: Test, adjust and record the following:

1. Heat Transfer Devices: Including, but not limited to air handlers, convectors, fin tube radiation sections, unit ventilators, fan coils, cabinet heaters, unit heaters, heat pumps, heat exchangers.

    a. GPM (coil and bypass)
    b. Entering water temperature
    c. Leaving water temperature
    d. Water pressure drop
    e. Complete nameplate data
    f. Entering steam pressure

2. Pumps:

    a. Check rotation
    b. GPM
    c. Pump off pressures (suction and discharge)
    d. Running suction pressure
    e. Running discharge pressure
    f. Running load amps
    g. RPM - motor

h. Complete nameplate motor and pump
i. Marked up pump curve illustrating final operating conditions

E. The final test and balance report shall be provided as a formal project submittal for review by the Engineer of Record.

END OF SECTION

SECTION 230710 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

A. Submit product data, product description, manufacturer's installation instructions.

B. Submit schedule of types and thicknesses for each application, and location of materials.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 232010 - Piping Systems and Accessories.

B. Section 233100 - Sheet Metal and Ductwork Accessories Construction.

PART 2 - PRODUCTS

2.1 GENERAL

A. See Exhibits at the end of this section for where insulating materials shall be applied, thickness, jacketing and remarks.

B. Provide work in compliance with the following Codes and Standards based on the current edition in effect at project location:

1. Energy Conservation Code of New York State.

C. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Products shall not contain asbestos, lead, mercury, or mercury compounds.

2. Insulation, including jackets, finishes and adhesives on the exterior surfaces of ducts, pipes, and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723.

a. Plenums: Insulation materials shall be noncombustible or listed and labeled per ASTM E84 or UL 723.

b. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments are not permitted.

3. All adhesives, coatings and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

4. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.

5. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

6. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C 871.

7. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C 795.

2.2 ACCEPTABLE MANUFACTURERS

A. Flexible Elastomeric: Armacell AP ArmaFlex/FS (Indoor: AP ArmaFlex up to 1", FS 1-1/2" to 2"; Outdoor: All sizes), Aeroflex (Indoors/Outdoors: All sizes), K-Flex Insul-Lock (Indoors: All sizes), K-Flex Titan (Indoors: Up to 1-1/2"; Indoors/Outdoors: All sizes), or approved equal.

B. Fiberglass: Johns Manville, Knauf/Manson, Owen-Corning, or approved equal.

C. Polyisocyanurate: Johns Manville Trymer 25-50 PIR (Indoors), or approved equal.

D. Fire-Rated Insulation: Unifrax -FyreWrap, 3M Fire Wrap, or approved equal.

E. Jacketing: Johns Manville (PVC) or approved equal.

F. Adhesives, Coatings, Mastics, Sealants: Childers, Foster, or approved equal.

2.2 FLEXIBLE ELASTOMERIC

A. Closed-cellular, sponge or expanded-rubber with integral vapor barrier.

B. Tube and Sheet:

1. Product meeting ASTM C 534, Type I/II Grade 1.

2. 'K' Value at 75°F mean temperature

a. 0.245 BTU-in/ft^2 hr. °F (up to 1 in. wall thickness).

b. 0.28 BTU-in/ft^2 hr. °F (1-1/2 in. to 2 in. wall thickness).

C. Sheet:

1. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.3 FLEXIBLE FIBERGLASS

A. Glass fibers bonded with a resin.

B. Blanket:

1. Product meeting ASTM C 553 Types I, II and III, and ASTM C 1290; Greenguard compliant.

2. 'K' Value: 0.27 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Maximum Service Temperature (Faced): 250°F.

4. Vapor Retarder Jacket: FSK conforming to ASTM C 1136 Type II.

5. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.4 RIGID FIBERGLASS

A. Pre-formed glass fibers bonded with a thermosetting resin.

B. Pipe:

1. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

2. 'K' Value: 0.23 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Maximum Service Temperature: 1000°F.

4. Vapor Retarder Jacket: Factory applied ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

5. Field applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV resistant fittings, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures to be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

C. Board:

1. Product meeting ASTM C 612 Type IA and IB. Maximum Service Temperature: 450º F.

2. 'K' Value: 0.24 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Vapor Retarder Jacket:

a. ASJ conforming to ASTM C 1136 Type I

b. FSK or PSK conforming to ASTM C 1136 Type II.

4. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.5 FIRE-RATED INSULATION

A. Fire-resistant wrap consisting of an inorganic fiber blanket encapsulated with a scrim-reinforced foil.

B. Blanket:

1. Product meeting ASTM E 2336, ASTM 814/UL 1479, ASTM E 136, ASTM E 119/UL 263, ASTM E 84/UL 723.

2. "K" value: 0.60 BTU-in/ft^2 hr. °F at 500°F mean temperature.

3. Maximum Service Temperature: 2300°F.

4. Thickness: 1-1/2 in., 0.9 lb/sq.ft.

5. Density: 6 PCF.

6. 2-hr rated.

2.6 FIELD APPLIED JACKETS

A. PVC: High-impact UV resistant PVC; roll stock ready for shop or field cutting and forming.

1. Thickness: 30 mil.

2. PVC Jacket Color: White.

2.7 ADHESIVES, COATINGS, MASTICS, SEALANTS

A. Provide per manufacturer product requirements for associated system and application/installation location.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work and installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system per manufacturer requirements. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air. Install insulation with longitudinal seams at top and bottom of horizontal runs. Install multiple layers of insulation with longitudinal and end seams staggered and with the least number of joints possible.

C. All pipe and duct insulation shall be continuous through hangers.

D. Provide thermal insulation on clean, dry surfaces and after piping, ductwork and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.

F. Items such as boiler manholes, handholds, clean-outs, ASME stamp, and manufacturers' nameplates, may be left uninsulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personnel injury: Piping from zero to seven feet above all floors and access platforms including hot (above 140°F) piping and any other related hot surface.

H. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

I. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

J. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

K. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

3.2 PENETRATIONS

A. Aboveground Exterior Wall: Install insulation continuously through penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above through surface and seal with joint sealant.

B. Interior Floor, Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Fire-Rated Floor, Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.3 PIPE INSULATION

A. All pipes shall be individually insulated. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system.

B. Piping insulation is allowed to be reduced in thickness only when a specific UL assembly detail for piping passing thru a rated wall indicates a maximum insulation thickness that is less than this specification section calls for. In this case reduce the insulation thickness just for the rated wall penetration. The reduction of insulation thickness shall be limited to the length of the penetration only.

C. Coordinate insulation installation requirements for heat tracing that may apply.

3.4 DUCTWORK INSULATION

A. Provide external thermal insulation for ductwork. Not required where ducts have internal acoustical insulation. Make special provisions at dampers, damper motors, thermometers, instruments, and access doors.

B. Provide factory ASJ jacket for ductwork required to be insulated and to be painted.

C. Laboratory Exhaust Duct Wrap: Install fire-rated duct wrap in strict accordance with the manufacturer's written installation methods.

3.5 EQUIPMENT INSULATION

A. Apply insulation with joints firmly butted as close as possible to the equipment surface.

3.6 EXISTING INSULATION

A. Patch existing insulation damaged during the course of the work.

EXHIBIT "I" - PIPE INSULATION MATERIALS

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Hot water and glycol/hot water (up to 200°F)	Rigid Fiberglass	1-1/2 in. and Larger: 2 in. 1-1/4 in. and Smaller: 1-1/2 in.	
Low temperature hot water (up to 140°F)	Rigid Fiberglass	1-1/2 in. and Larger: 1-1/2 in. 1-1/4 in. and Smaller: 1 in.	
Chilled water (temperature greater than 40°F)	Rigid Fiberglass or Rigid Polyisocyanurate	1-1/2 in. and Larger: 1 in. 1-1/4 in. and Smaller: 1/2 in.	
Concealed AC unit condensate drains	Rigid Fiberglass	All Sizes: 1 in.	

NOTES FOR EXHIBIT "I":

NOTE 1: Use cork insulation tape equal to K-flex Cork Tape for cold service piping where installed inside equipment valve compartment (fan coil, etc.).

NOTE 2: All interior exposed piping, valves, fittings, and specialties less than 8'-0" above finished floor in mechanical/electrical rooms shall be jacketed with PVC.

EXHIBIT "II" - DUCT INSULATION MATERIALS

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Supply (concealed)	Flexible Fiberglass	2 in.	Min. installed R value of 6
Supply (within mechanical rooms or exposed at 8'-0" or less above finished floor)	Rigid Fiberglass	1-1/2 in.	Min. installed R value of 6
Outside air ducts and plenums, connections and mixing boxes	Rigid Fiberglass	2 in.	Min. installed R value of 8
Neutral ventilation air supply ducts (between 65°F and 80°F)	Not insulated	Not insulated	
Return and exhaust within heated building envelope	Not insulated	Not insulated	
Lab exhaust ducts within building envelope, where noted (W)	Fire Rated Blanket	1-1/2 in.	1 layer
Exhaust, relief or vent ducts and plenums (concealed)	Flexible Fiberglass	2 in.	Min. installed R value of 6 Insulate ducts 15 ft. from exterior opening and plenums.
Exhaust, relief or vent ducts and plenums (exposed)	Rigid Fiberglass	1-1/2 in.	Min. installed R value of 6 Insulate ducts 15 ft. from exterior opening and plenums.

EXHIBIT "III" - EQUIPMENT INSULATION MATERIALS

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Filter assembly housings and sound attenuators when factory un-insulated	Rigid Fiberglass	Same as associated ductwork	
Air removal assemblies and fabric filter assemblies		Same as water piping	
Heating system expansion tanks and chemical feed tanks	Not insulated	Not insulated	
Chilled water pumps	Flexible Elastomeric	1 in.	Arrange for easy removal and reinstallation.

NOTES FOR EXHIBIT "III":

NOTE 1: Insulate any cold surfaces subject to condensation that have not been factory insulated.

NOTE 2: All interior exposed equipment insulation less than 8'-0" above finished floor in mechanical/ electrical rooms, penthouses, and services aisles/pipe chases shall be jacketed with PVC (for cold services) and aluminum (for hot services).

END OF SECTION

SECTION 230901 - BUILDING AUTOMATION CONTROL SYSTEM COMMUNICATIONS

PART 1 - GENERAL

1.1 INTRODUCTION

A. Building automation and direct digital control systems throughout Cornell require integration to the campus Energy Management and Control System (EMCS). To ensure compatibility, all installations of digital building automation and control equipment shall support communications via the BACnet standard, ANSI/ASHRAE Standard 135-2012, BACnet® - A Data Communication Protocol for Building Automation and Control Networks and the related international standard, ISO 16484- 5.

1.2 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation of the Building Automation Control System (BACS) designed in Contract Drawings and described in Section 230923. The Building Automation Control System (BACS) to perform the communication and interoperability requirements as described in this Section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230923 – Building Automation Control System.

1.4 APPLICABLE STANDARDS

A. The following standards shall govern the design and selection of equipment supplied to fulfill the requirements of this section:

1. ANSI/ASHRAE Standard 135-2012: *BACnet®. - A Data Communication Protocol for Building Automation and Control Networks*, as amended, and hereinafter referred to as "BACnet". American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 2012.

2. ATA/ANSI 878.1 (1992), ARCNET Local Area Network.

3. ISO/IEC 8802-3 (1993), Information processing systems - Local area networks - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

1.5 DEFINITIONS

A. In addition to the definitions contained in the applicable standards, the following should be noted:

1. ARCNET: Attached Resource Computer Network. See BACnet, Clause 8 and ATA/ANSI 878.1.

2. BACnet/IP: BACnet Annex J Devices. Annex J of BACnet describes how BACnet devices can make use of IP directly for communicating across IP-based internets.

3. BACnet PICS; A Protocol Implementation Conformance Statement that describes the BACnet capabilities of a specific device. See BACnet, Annex A.

4. BACS: Building Automation and Control System.

5. BACSI: The Building Automation and Control Systems Integration group within the Cornell Facilities and Campus Services organization. BACSI is responsible for the EMCS and the coordination of BACS device addressing and network numbering.

6. BBMD: BACnet Broadcast Management Device. See BACnet, Annex J.

7. BI: BACnet International. The trade association responsible for the worldwide promotion of BACnet.

8. BIBB: BACnet Interoperability Building Block. A collection of one or more BACnet services defined for the purpose of describing communication functionality in an unambiguous way. See BACnet, Annex K.

9. BTL: The BACnet Testing Laboratories of BI. The organization responsible for testing products to assure that they conform to the BACnet standard. Listings of tested products are available at www.bacnetassociation.org.

10. Campus Backbone: A fiber optic data communication infrastructure on the Cornell campus managed by CIT. Users connect to the backbone by means of CIT-supplied Ethernet switches in each building and appropriate 10/100/1000BASE-T unshielded, twisted pair wiring. The backbone uses IP for routing messages to and from computers both on and off the Cornell campus.

11. CIT: Cornell Information Technologies. The organization that manages the Cornell campus networking infrastructure, including the provision of network connections in Cornell buildings.

12. Device Profile: A collection of BIBBs that describes the minimum BACnet capabilities of a particular device in order to achieve reliable communication in one of five specified "interoperability areas." Devices include BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC) and BACnet Application Specific Controllers (B-ASC). See BACnet, Annex L.

13. EMCS: A computer complex that provides Energy Management and Control System functions for the University. The EMCS is connected to the campus backbone and uses IP for the routing of messages to and from individual buildings, and allows 24/7 monitoring of BACS alarms. The EMCS also provides other infrastructure monitoring and control functions for campus utilities and CIT's network operations.

14. Ethernet: A carrier sensing multiple access with collision detection network technology defined by ISO/IEC 8802-3.

15. Gateway: A device that translates BACnet messages into those of a non- BACnet protocol and vice-versa.

16. Internetwork: A set of two or more BACnet networks interconnected by routers.

17. Interoperability Area: A communications domain in which functional cooperation is desired. These areas are currently: 1) data sharing; 2) alarm and event management; 3) trending; 4) scheduling; and 5) device and network management. See BACnet, Clause 22.

18. IP: The Internet Protocol. A networking protocol originally developed by the federal Defense Advanced Research Projects Agency. BACnet messages can traverse the campus backbone by being encapsulated in routable IP packets.

19. Local: Pertaining to the requirements of a specific job or building project.

20. LAN: Local Area Network. One of the approved BACnet network technologies: Ethernet, ARCNET or MS/TP.

21. MS/TP: Master-Slave/Token-Passing Network. One of the approved BACnet LANs. See BACnet, Clause 9.

22. Network: One of the communication technologies for data communications specified in BACnet. Approved network technologies at Cornell are Ethernet, ARCNET, and MS/TP.

23. PICS: Protocol Implementation Conformance Statement. A document that describes in detail a device's BACnet capabilities. See BACnet, Annex A.

24. PM: Project Manager. The Owner's representative who oversees a BACS project.

25. Synchronization: In order to ensure that alarms are properly interpreted, the names of all BACnet objects within a device are stored in an EMCS database. This process of coordinating the names of the objects in the field devices and the EMCS is initiated manually whenever a device is installed or its objects have been updated. The EMCS reads the Object_List property of the device's Device object (a BACnetARRAY of Object Identifiers) and then reads each object's Object_Name property (a CharacterString). This Object_Name is used along with the EMCS device name to identify the alarms related to this object so it must be unique and descriptive.

26. UDP: The User Datagram Protocol. One of the IP family of protocols. UDP is used to convey BACnet/IP messages and is characterized by a "port number" for each protocol. BACnet/IP typically uses UDP port X'BAC0' or decimal 47808.

27. VLAN: Virtual Local Area Network. A network configuration that allows devices to communicate across multiple physical local area networks (LANs) using their hardware or "medium access control" (MAC) addresses as if they shared a common networking medium. As with a physical LAN, "local" broadcast messages are also propagated to each of the participating LANs. VLAN capability depends on the configuration of the interconnecting data communication equipment. VLAN configuration is performed by CIT.

28. Zone: The facilities on the Ithaca campus are divided into groups called "zones" for the purpose of maintenance management. Each has a "Zone Facility Manager" and controls technicians responsible for the BACS equipment in their zone.

1.6 SUBMITTALS

A. In addition to any requirements specified elsewhere, the Contractor shall provide both proposed and as-built versions of the following:

1. Schematic drawings that represent the system architecture and configuration, in both hardcopy and editable electronic format.

2. A points list that includes, for each physical or logical point, the name, description, display units, alarm limits and definitions, along with the BACnet object description, object ID, and associated device ID. The list shall also indicate whether Trend Log or Schedule objects have been established for the point.

3. Documentation for any non-standard BACnet objects, properties, or enumerations utilized detailing their structure, data types, and any associated lists of enumerated values.

4. PICS files indicating the BACnet functionality and configuration of each device. In addition to the requirements of BACnet, Annex A, the Contractor shall provide information on any limitations on the numbers of supported objects in a given device including, specifically, Trend Log and Schedule objects.

5. Documentation on submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL). If, for any reason, BTL testing and listing has not been completed, a written commitment shall be provided to upgrade installed controls to a version that meets BTL testing and listing requirements should deficiencies be found during BTL testing.

1.7 WORK INCIDENTAL TO TEMPERATURE CONTROL CONTRACTOR

A. The Contractor shall be responsible for all coordination of subcontractors’ work relative to the BACS. Specific questions relating to communication and interoperability shall be submitted to BACSI.

PART 2 - PRODUCTS

2.1 GENERAL

A. Each networked device supplied pursuant to this section shall be installed and configured to correctly execute all sequences of operation for its intended application, as defined in other sections of this guideline. In addition, each networked device shall provide, at a minimum, the BACnet communication capabilities prescribed in the device profiles for devices of its type.

2.2 CONTROLLER

A. Controller devices supplied to meet the functional and operational requirements of this guideline shall conform, at a minimum, to one of the BACnet device profiles contained in BACnet, Annex L: BACnet Building Controller (B-BC), BACnet Advanced Application Controller (B-AAC) or BACnet Application Specific Controller (B-ASC). The interoperability requirements of such devices are contained in BACnet, Annex L. B-BC controller devices shall communicate using BACnet/IP. Other devices may use BACnet over ARCNET or BACnet over MS/TP.

2.3 ROUTER

A. In the event that devices are provided that do not use BACnet/IP over Ethernet as their communication technology, BACnet routers shall be provided that route between BACnet/IP over Ethernet and the other BACnet LAN type(s), whether ARCNET or MS/TP. These routers shall conform to the specifications of BACnet, Clause 6.

2.4 GATEWAY

A. BACS devices that use BACnet as their native protocol are preferred. The use of gateways, in circumstances where no native BACnet devices are available, requires the specific approval of the Owner in each instance.

2.5 SWITCH & HUB

A. If the network topology of the job requires the use of network switches, they shall be selected from the list of approved hardware, which can be found at https://pminfo.emcs.cornell.edu/switch_hardware. In the event the job requires additional switches, the proposed design of the network topology including all CIT jacks, switches, and network connected BACS devices shall be submitted in advance to BACSI for approval. Schematic examples of typical extended network topologies can be referenced at the pminfo web site referenced above.

2.6 NON-BACNET DEVICE

A. For devices that are used for utility metering and other non- BACS applications, the Cornell EMCS provides several protocol handlers including Modbus and EtherNet/IP. Contractors supplying devices using these protocols need not provide a gateway.

2.7 WORKSTATION

A. The EMCS operator interface is the responsibility of BACSI. If, however, a specific job requires a local workstation, the Contractor shall provide a personal computer of current design and approved by the Owner equipped with a web browser that can display information from a Contractor-supplied web server that interfaces with the local BACnet network and the campus backbone.

2.8 WEB SERVER REQUIREMENTS

A. If a local workstation is required, the Contractor shall provide a web server computer with the web page presentation, data acquisition and storage functionality described in this section, including the specific functions listed below. The web server shall be configured in such a way that there is no software-imposed limit to the number of simultaneous users.

1. Data Sharing

a. Presentation of data (i.e., user definable reports and graphics)

b. The ability to monitor and display the values of all BACnet object types, including all required and optional properties

c. The ability to modify setpoints and parameters

2. Alarm and Event Management

a. Operator notification and presentation of event information

b. Alarm acknowledgment by operators

c. Alarm summarization

d. Adjustment of alarm limits

e. Adjustment of alarm routing

3. Scheduling

a. Modification of schedules

b. Display of the start and stop times (schedule) of scheduled devices

4. Trending

a. Modification of the parameters of a trend log

b. Display and archive of trend log data

5. Device and Network Management

a. Display of information about the status of any device on the BACnet internetwork

b. Display of information about any object on the BACnet internetwork

c. Ability to silence a device on the network that is transmitting erroneous data

d. Ability to cause a remote device to reinitialize itself

e. Ability to backup and restore the configuration of devices on the local BACnet network

f. Ability to query and change the configuration of local BACnet routers

2.9 DUAL HOME EQUIPMENT

A. To protect network security, dual-homed devices, i.e., devices with two (or more) Network Interface Cards that have an identity on a BACSI-administered LAN and another non-BACSI-administered LAN, e.g., a locally administered laboratory LAN is strictly prohibited without prior written authorization by BACSI.

2.10 LAN

A. All control devices meeting the B-BC device profile shall be connected to an ISO 8802-3 (Ethernet) LAN provided by the Contractor. This LAN, in turn, shall be connected to the campus backbone network. Unless otherwise specified, the connection shall be via a 10/100/1000BASE-T port provided by the Owner. The location of the jack will be determined in consultation with BACSI, which will arrange for the jack's installation. The Contractor shall also provide any additional data communication hardware, such as switches, hubs, and repeaters that may be needed to interconnect the supplied BACS equipment and to connect to the Owner's backbone network. Although cascaded switches and hubs are not prohibited, they must meet the requirements.

B. To facilitate maintenance technician access to the LAN, the Contractor shall also provide at least one additional 10/100/1000BASE-T access point in each mechanical room that contains BACS equipment. This requirement may be met by supplying either a hub with a spare port or a dedicated jack.

C. Control devices that meet the B-ASC profile, but do not support Ethernet, must use another approved BACnet LAN technology. These technologies are ARCNET and MS/TP. If Ethernet is not supported on any part of the internetwork, a standalone BACnet router, or a BACnet Building Controller with built-in routing capability, must be provided for routing between the Ethernet and ARCNET or MS/TP LANs.

PART 3 - EXECUTION

3.1 DATA SHARING

A. Data Sharing requirements apply to the exchange of information between BACnet devices for archival storage, generating graphics and reports, the sharing of common sensor or calculated values, carrying out interlocked control strategies, and the modification of setpoints or other operational parameters.

B. All such data to be exchanged shall be represented as BACnet objects and conveyed using BACnet messages. Only standard BACnet objects and messages may be used to implement data sharing requirements unless the non-standard extensions are explicitly approved by the Owner. Any extensions to BACnet shall be fully documented in the manner used within the BACnet standard. Submission of such documentation is a prerequisite for obtaining approval of an extension.

C. Points List: The Contractor shall provide devices installed and configured with all points indicated in the BACS points list. The Contractor shall provide any additional points needed to fully implement the sequence of operations and other functionality described in this guideline.

D. Data Presentation: The following characteristics shall apply to graphic displays:

1. The graphic displays shall include schematic diagrams of the systems being displayed.

2. When a graphic display is being viewed, all values displayed shall be updated when a change of value (COV) notification is received or, if COV is not implemented, within five seconds.

3. Any data value from any networked device shall be available for plotting in real time. The operator shall be able to select binary and analog data concurrently and to plot multiple instances of each datatype on the same screen. The operator shall be able to select sampling intervals from 1 second to 60 seconds. For devices that implement COV reporting, the operator shall be able to select this as the means to update the plot. It shall be possible to save such real-time plots for subsequent recall.

E. Monitoring of Any Property: The operator shall be able to display any value of any property of any object from any networked device including all properties required by BACnet, all supported optional properties, and any proprietary extensions.

F. Global Object Definitions: The control system shall be configured with system- wide unique BACnet objects as needed to convey all globally significant information necessary to implement the control strategy.

G. Setpoint and Parameter Modifications: Operators with appropriate authority shall be able to modify all control loop setpoints and tuning parameters via BACnet messages initiated through operator interaction with graphics displays.

H. Peer-to-Peer Data Dependencies: All BACnet devices shall be installed and configured to exchange data values directly, without the need for operator intervention, to implement the sequence of operations specified in the mechanical system drawings and to share global data values. BACnet network points set up to acquire data from a peer device shall use dynamic binding. If static binding configurations are necessary, prior permission from BACSI must be obtained.

3.2 ALARM AND EVENT MANAGEMENT

A. Alarm and Event management is the exchange of data between BACnet devices related to the occurrence of predefined conditions that meet specific criteria. Such conditions are called "events" and may be the basis for the initiation of a particular control action in response or the simple logging of the event's occurrence. The event may also be deemed to represent a condition that constitutes an "alarm" requiring human acknowledgment and intervention.

B. All alarms and events shall be implemented using standard BACnet event detection and notification mechanisms. Either intrinsic reporting or algorithmic change reporting may be used but the intrinsic reporting method is preferred. See BACnet, Clause 13.

C. Alarm Lists

1. The Contractor shall provide devices installed and configured to detect alarms and events for the points indicated in the system drawings. Software logic shall be provided to avoid nuisance alarms, e.g., no temperature or status alarms shall be generated when fan systems are not running or during start-up and shutdown transitions. It shall be possible to configure a delay between the occurrence of an alarm condition and its enunciation.

2. Alarms shall be annunciated on the network within five seconds of their occurrence. The graphics shall display an alarm message window that appears on top of any other open windows. The alarm message window shall have a distinctive color and appearance to attract the operator's attention. Operators with sufficient privilege shall be able to configure the controls to emit an audible signal (or not) when an alarm message is received.

3. Alarms that require operator acknowledgement shall cause the alarm window to remain active until such an acknowledgement is received. If multiple alarms are received, unacknowledged alarms shall be displayed on a first come first served basis grouped by priority, with the highest priority alarms displayed first.

4. Alarms shall be distributed using the BACnet notification class mechanism. Assignment of classes and destinations shall be configured according to details provided by the Owner.

5. BACnet provides a mechanism for prioritizing alarm and event notification messages using a numerical range of 0-255 with 0 being the highest priority and 255 being the lowest priority. The priorities are consistent with the safety requirements of UL 864 (applies to fire systems) and UL 1076 (applies to security systems).

6. Alarm and event notification priorities shall be configured in the Priority Range and shall be conveyed using the indicated Network Priority. See BACnet, Clause 6.

7. See Exhibit "A", "Cornell Alarm and Event Priorities" at end of this Section for configuration and priorities of all alarms and event notifications.

D. Alarm Acknowledgment: Alarms shall be acknowledged through the EMCS alarm acknowledgement process.

E. Alarm Summarization: Alarm summarization shall be handled through the EMCS alarm summarization process.

F. Alarm Parameter Adjustment: Operators with sufficient privilege shall be able to change alarm parameters for all standard BACnet event types.

G. Alarm Routing Adjustment

1. Operators with sufficient privilege shall be able to change alarm routing (BACnet notification classes) for each alarm including the destination for each type of alarm and alarm priority, the day of week, time of day, and the type of transition involved (TO-OFFNORMAL, TO-NORMAL, etc.).

2. Initially, notification classes shall be configured in a manner that distinguishes between the EMCS and any local alarm.

3.3 SCHEDULING

A. Scheduling is the exchange of data between BACnet devices related to the establishment and maintenance of dates and time at which specified output actions are to be taken. All schedules shall be implemented using BACnet objects and messages.

B. Schedule Lists

1. The Contractor shall provide devices installed and configured with start/stop, mode change, and night setback schedules as defined in the sequence of operations. As part of the installation process, the Contractor shall configure vacation, holiday, and any special event schedules as provided by the Owner.

2. The system shall have the ability to program alterations to programmed operating schedules based on the priority of events.

3. Based on operator privileges, the operator shall have the ability to temporarily override the programmed schedule of equipment. Operational override of a programmed schedule shall be for a specific duration following which the schedule shall revert back to the preprogrammed schedule.

C. Display of Start and Stop Times and Actions: An operator shall be able to inspect the content of any schedule and determine the specific control actions that will occur at any time, on any date. For any particular device or system parameter that is the subject of a schedule, an operator shall be able to determine the schedule of actions related to that particular device or parameter.

D. Modification of Schedules: All calendar entries and schedules shall be modifiable from the EMCS or locally by an operator with sufficient privilege.

3.4 TRENDING

A. Trending is the accumulation of (time, value) data pairs at specified rates for a specified duration. Trends are distinguished from real-time plotting of data by the fact that the data are destined for long-term storage.

B. Archival Storage of Data: Archival storage of data will be handled by the EMCS. However, the Owner may specify local trend archiving and display through the use of BACnet Trend Log objects.

C. Modification of Trend Log Parameters: An operator with sufficient privilege shall be able to change the data points to be logged, the sampling rate, and the duration of a trend log.

3.5 DEVICE AND NETWORK MANAGEMENT

A. Device and network management is the exchange of data between BACnet devices concerning the operation and status of specific devices. The following functions shall be available:

1. Display of Device Status Information: Operators shall be able to display at any time the operational status of any device on the BACnet internetwork.

2. Display of BACnet Object Information: Operators shall be able to display at any time any property of any BACnet object. Operators shall be able to display property values of objects grouped by object type, object location, and building system.

3. Silencing Devices that are Transmitting Erroneous Data: Operators shall be able to direct a field device to stop transmitting event, alarm, or COV notifications until a subsequent command to resume transmissions is received.

4. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device or all devices on a single local network.

5. Remote Device Re-initialization: Operators shall have the ability to issue re-initialization commands to any device that supports remote re-initialization.

6. Backup and Restore: Operators shall have the ability to backup and restore all BACnet devices on the network that support this capability.

7. Configuration Management of Half-Routers, Routers and BBMDs: Operators shall have the ability to display and modify the routing table entries in all supplied BACnet half-routers and routers and the broadcast distribution and foreign device registration tables in all BBMDs. Cornell BACS networks typically employ non-vendor-supplied BBMDs. Therefore, BACS devices should never be configured as a BBMD without prior authorization from BACSI.

3.6 USE OF BACNET OBJECTS

A. Naming Conventions: The following sections list the requirements for the assignment of names and identifiers for BACnet objects.

1. Device Names:

a. The EMCS uses a system for naming its control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served.

b. Names can be up to 254 characters in length, without embedded spaces. Only the characters A-Z, 0-9, ".", and "-" may be used.

c. The goal is the shortest descriptive, but unambiguous, name. For example, if there were only one chilled water pump "P1", a valid name would be "DUFFIELD.CW.P1.CONTROL". If there are two pumps designated "P1", one in the basement mechanical room and one in the penthouse mechanical room, the names could be "CHP.BSMT.CW.P1.CONTROL" or "CHP.PENT.CW.P1.CONTROL". In the case of unitary controllers, for example a VAV box controller, a name might be "COURT.122.TV- LOUNGE". These names should be used for the value of the "Object_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

2. Device Instance Numbers

a. BACnet allows 4194304 device instances per BACnet internetwork, each of which must be unique. Cornell's unique device instances are formed as follows: Device Instance = "FFFFNDD" where:

1) FFFF = Facility Code

2) N = 0-9 This allows up to 10 networks per facility or building

3) DD = 00-99 This allows up to 100 devices per network

b. Facility Code assignments are unique four digit numbers assigned by the Facilities Inventory Office. Some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored.

c. Network numbers for facility codes above 4193 and for facilities that require more than 10 BACnet networks will be assigned in the range 0000-0999.

d. The Contractor shall contact BACSI for assignment, or confirmation, of the BACnet network and device instance numbers to be used prior to beginning device configuration. In the event of renovation or addition, the existing device instances are available and should be planned around as part of the project.

3. Non-Device Object Names: Objects other than Device objects shall be named in a manner analogous to Device objects. The names shall consist of a facility. [sub-facility] system. [sub-system] point designation. All BACnet object names within a particular device must be unique within that device. For those objects that will be used to generate alarms, the point name should be descriptive of the alarm. Point names are synchronized with the EMCS database at the completion of each installation or update and the object name will appear in the EMCS alarm notification.

4. Non-Device Object Instance Numbers: The instance numbers for objects other than Device objects may be assigned at the Contractor's discretion subject only to the constraint that they be unique for a given object type within a given device.

B. Commissioning / Diagnostic Mode: In order to support commissioning and troubleshooting functions, the Out_Of_Service property of all Analog, Binary, Multi-state, Loop, and Program objects shall be writable using BACnet services.

C. Using Object Descriptions

1. Each Device object and every object in BACnet Building Controllers (B-BC) shall be configured with a Description property. The descriptions used shall be submitted to the Owner for approval.

2. For all object types in all devices that support Description properties, the available string length and whether or not the Description is writable using BACnet services shall be specified in the device's PICS.

D. Issues Relating to Specific BACnet Object Types: This section provides requirements that pertain to the use of specific BACnet object types. For those object types that support Change of Value (COV) reporting, the COV_Increment must be set to a value appropriate for the parameter being measured, typically 10% of the normally expected steady state value.

1. Analog Input, Output, and Value: All Analog_Input, Analog_Output, and Analog_Value objects shall have the capability of using the COV reporting mechanism and the COV_Increment property shall be writable using BACnet services.

2. Binary Input: The Inactive_Text and Active_Text properties of Binary Input objects shall be configured with text string values as indicated on the points list. Binary Input objects shall support COV reporting.

3. Binary Output: The Inactive_Text and Active_Text properties of Binary Output objects shall be configured with text string values as indicated on the points list. All Binary Output objects associated with motor on/off status shall track changes of state and runtime. Binary Output objects shall support COV reporting.

4. Binary Value: The Inactive_Text and Active_Text properties of Binary Value objects shall be configured with text string values as indicated on the points list. Binary Value objects shall support COV reporting.

5. Calendar: Devices providing scheduling capability shall also provide at least one Calendar object with a capacity of at least ten entries. Operators shall be able to view the calendar object and make modifications. If the Calendar's Date_List property is writable using BACnet services, all calendar entry datatypes shall be supported.

6. Loop: All control loops using any combination of proportional, integral, and/or derivative control shall be represented by BACnet Loop objects. Operators with sufficient authority shall be able to adjust at least the Update_Interval, Setpoint, Proportional_Constant, Integral_Constant, and Derivative_Constant using BACnet services. Loop objects shall support COV reporting.

7. Multi-state Input, Output, and Value: The text to be used for the Multi-state object types shall be determined from the points list. Feedback_Value shall be determined by sensing the actual condition or mode of the device. All Multi- state objects shall support COV reporting.

8. Schedule: All building systems with date and time scheduling requirements shall have schedules represented by BACnet Schedule objects. All operators shall be able to view the entries for a schedule. Operators with sufficient privilege shall be able to modify schedule entries. Required schedules are shown on the drawings as part of the occupied and unoccupied modes.

E. Dynamic Object Creation: BACnet Building Controllers shall be configured to allow the dynamic creation of Trend Log, Calendar, and Schedule objects by means of the BACnet CreateObject service.

3.7 USE OF BACNET SERVICES

A. Interoperable Commands: All dampers, valves, fans, or other mechanical equipment that may need to be controlled by more than one application shall be represented as commandable BACnet objects. The application programs interacting with this equipment shall be configured to use the command priorities listed in Table 2. If implementing the sequence of operations or other required functionality requires using a command priority not listed in Table 2, the priority assignment must be approved by the Owner.

B. See Exhibit "B", " Cornell Command Priorities " at end of this Section for configuration of all command priorities.

C. Alarming: This section provides requirements that are specific to the use of BACnet for alarm processing.

1. Notification Classes:

a. The EMCS shall be designated as a recipient for all alarm notifications.

b. The Priority, Ack_Required, and Recipient_List properties of Notification Class objects shall be writable over the network using BACnet services.

2. Event Notification Message Texts: Alarm and event processing shall be configured to convey descriptive text messages along with the notification.

D. Operator Authority Levels: There shall be at least three levels of authority:

1. Administrator - All privileges

2. Controls Technician - All programming and configuration

3. Building Coordinator - Read only

4. Commissioning Agent – Read only

5. A/E, Consultant, Facilities - Read only

E. Change of Value Processing

1. Property values shall be displayed based on the receipt of confirmed and unconfirmed Change of Value notifications. Operators shall have the ability to subscribe to COV notifications for all objects that support COV subscriptions.

2. After initialization, all graphic display screens shall update the displayed values using COV notifications if COV notification capabilities are available from the data source.

3. The COV increment shall be adjustable by an operator using BACnet services.

3.8 LOCAL AREA NETWORKS

A. This section provides requirements that are specific to the integration of multiple BACnet networks, possibly on different LAN types, into a single BACnet internetwork.

B. Network Numbering:

1. Cornell BACnet network numbers are based on a "facility code, network" concept. The "facility code" is the Cornell-assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internetwork.

2. Cornell's network numbers are thus formed as follows: Network Number = "FFFFN" where:

a. FFFF = Facility Code

b. N = 0-9 This allows up to 10 networks per facility or building

3. N = 0 (zero) will generally be assigned to a facility's BACnet Ethernet LAN. Normally, this network is connected to the campus backbone. The additional N-numbers will be assigned to any ARCNET or MS/TP networks as required.

4. The Contractor shall contact BACSI for assignment, or confirmation, of the Network Number(s) to be used prior to beginning device configuration.

C. IP Address Assignments:

1. Cornell maintains specially configured VLANs for the purpose of securely transporting BACS communication traffic. Address assignments are coordinated by BACSI.

2. The Contractor shall contact BACSI for assignment of IP addresses (and possibly non-standard UDP ports) prior to beginning device configuration.

3.9 BACNET ROUTERS

A. The Contractor shall configure each BACnet router to transmit network layer (routing) error messages to the EMCS.

3.10 PROCEDURES

A. For demolition or removal of existing control equipment, or the addition of new control equipment on the campus backbone network, the contractor shall inform the Energy Management and Control System (EMCS) Operations at 607-255-5777 prior to any potential connection to, or interruption of, the data communication network. Additional current information can be found at pminfo.emcs.cornell.edu.

B. Installation, Modification, Retrofit, and Removal of BACS Hardware and Software:

1. Prior to commencing work:

a. The Contractor shall notify EMCS of the scope of work, date work is to start, tentative schedule of remaining work, and the contact information for the responsible application engineer, technicians and contractor personnel.

b. On larger Projects (300 or more devices), the Contractor shall conferred with EMCS/BACSI regarding measures to be employed during construction to protect the BACS network infrastructure of the University before and during the project, e.g., firewalls, sequestered construction servers, Virtual Private Network connections, etc. Transfer of programs, point names, and other configuration from the construction server to the production server should be done by the vendor as part of commissioning.

c. The Contractor shall review with, and provide documentation to, EMCS/BACSI regarding the network topology and device instance numbering scheme for the new controls being installed. Upon job completion, accurate as-built drawings are required that clearly show the network topologies including all switches, repeaters, and devices, both for IP and child MS/TP and ARCNET networks.

d. The Contractor confers with the Zone Facility Manager prior to any demolition activities. Demolition activities should be planned to proceed in an orderly way to minimize impact and disruption to Campus BACS networks.

2. On Projects involving retrofit/replacement of existing BACS devices in a facility:

a. Upon request, EMCS will provide an MS-Excel spreadsheet that indicates which existing points appear in EMCS graphics, trends and reports; which points have previously come into alarm; and the remaining points in the controller.

b. The Contractor shall then provide to EMCS a mapping of all controller points that have been renamed or removed showing the old and new designation or status.

c. The Contractor shall inform EMCS of all changes to communication, including any addresses that have been retired, replaced, etc., so that the Owner's network database can be kept current.

d. As new BACS devices are added to Campus networks, the Controls Contractor shall complete and submitting the appropriate checklists for EMCS/BACSI and EMCS General Foreperson review. Visit http://pminfo.emcs.cornell.edu for downloadable copies of the checklists. Devices added to in-service non-sequestered building automation networks must be configured and submitted to EMCS for definition and synchronization within one business week of activation.

3. When the Controls Installation is complete and the project desires alarm reporting to EMCS:

a. EMCS/BACSI shall review with the Contractor previous submitted documentation, status of job, and network safety measures in place.

b. EMCS/BACSI will work with the PM and the Contractor to complete final integration of new controls into the Campus BACS infrastructure, including defining and synchronizing field panels with the EMCS database for alarm reporting.

C. Check out of BACnet/IP Installations

1. Prior to connection to the Campus backbone network, it must be demonstrated to the EMCS General Foreperson that these criteria have been met:

a. The IP address, subnet mask and IP gateway address of the device to be connected must be shown to be correct for the network connection about to be made.

b. The device's Device Name must be shown to conform to Cornell standards.

c. The names of BACnet objects within a device must be shown to conform to Cornell's naming conventions.

d. The device's Device Instance Number (DIN) must be shown to conform to Cornell's naming conventions.

2. In the case of devices that route to subordinate BACnet MS/TP or ARCNET networks, the network numbering must be shown to conform to Cornell numbering standards.

3. The BACnet alarm Recipient List must contain the DIN (or BACnet Address, i.e., [BACnet Network Number, MAC Address]) of both the appropriate vendor server (ALC or Alerton) and the EMCS alarm server.

4. For each device containing network variables, a list of network variables must be provided showing that each network variable references a valid network-accessible point.

5. For each device containing points that are to issue UnconfirmedCOVNotifications, a list of the points and their respective Change of Value (COV) increments must be provided to prove that the device will not generate COV storms.

6. BACnet Broadcast Management Device (BBMD) capability must be shown to be disabled unless explicitly authorized by Cornell, i.e., the device's Broadcast Distribution Table (BDT) must be shown to be empty or non-existent.

7. Ethernet devices must be connected to CIT provided Ethernet network jacks, or a CIT managed switch. In the event a switch needs to be installed in a mechanical room, closet, enclosure, or other non-CIT node room location, the switch can be procured from CIT network engineering. The equipment used must be selected from the list of approved equipment.

EXHIBIT "A" – CORNELL ALARM AND EVENT PRIORITIES

MESSAGE GROUP	PRIORITY RANGE	NETWORK PRIORITY	BRIEF DESCRIPTION
Life Safety	0 - 31	Life Safety Message	Notifications related to an immediate threat to life, safety, or health such as fire detection or armed robbery
Property Safety	32 - 63	Life Safety Message	Notifications related as an immediate threat to property such as forced entry
Supervisory	64 - 95	Critical Equipment Message	Notifications related to improper operation, monitoring failure (particularly of Life Safety or Property Safety monitoring), or monetary loss
Trouble	96 - 127	Critical Equipment Message	Notifications related to communication failure (particularly of Life Safety or Property Safety equipment)
Miscellaneous Higher Priority Alarm and Events	128 - 191	Urgent Message	Higher-level notifications related to occupant discomfort, normal operation, normal monitoring, or return to normal
Miscellaneous Lower Priority Alarm and Events	192 - 255	Normal Message	Lower-level notification related to occupant discomfort, normal operation, normal monitoring, or return to normal

EXHIBIT "B" – CORNELL COMMAND PRIORITIES

PRIORITY LEVEL	APPLICATION	PRIORITY LEVEL	APPLICATION
1	Manual-Life Safety	9	Available
2	Automatic-Life Safety	10	Available
3	Available	11	Load Shedding
4	Available	12	Available
5	Critical Equipment Control	13	Available
6	Minimum On/Off	14	Available
7	Available	15	Available
8	Manual Operator	16	Available

END OF SECTION

SECTION 230923 - BUILDING AUTOMATION CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

A. The Building Automation Control System (BACS) is configured as a network with control functions at multiple levels, and with multiple points of operator control and supervision. The BACS includes web-based access, the Energy Management and Controls System (EMCS), data transmission systems, field panels and controllers, necessary interfacing controls, sensors and actuators. The controllers contain microprocessors and other supporting electronics that perform local control functions and execute application programs without requiring communications with the centralized head-end computers or workstations.

1.2 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings. Provide a complete Building Automation Control System (BACS) and extend the existing BACS to perform the functions described in this Section. All new equipment shall be compatible with the existing system. Provide wiring and conduit required to connect devices furnished as a part of, or accessory to, this automatic control system. Control wiring is defined as wiring up to and including 120 volts. Install wiring in accordance with requirements of "Electrical Wiring" in Section 230504, and the National Electrical Code. Provide all required devices for proper system operation, including special electrical switches, transformers, relays, pushbutton stations, etc.

1. All Actuation of valves and dampers shall be electric unless specifically called out elsewhere in the specifications or drawings.

B. The BACS shall have the following capabilities as described in these specifications:

1. The network controllers shall be connected directly to the Owner's Ethernet Network. The network controller shall also contain SNMP for integration to the Owner's Network Controllers System.

2. The system shall be capable of sending both emails and text messages and phone numbers for alarms. Coordinate with the Owner for email addresses, phone numbers and alarms.

3. Network controllers shall all be flash upgradeable and not require changing chips for upgrades.

4. Short term logging of historical data shall be provided for every BACS input and output in the system.

C. The BACS shall consist microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

D. The system shall consist of the following components:

1. Provide Ethernet-based network controllers as described in this specification. Controllers shall connect directly to the Operator Workstation over Ethernet, provide communication to the Standalone Digital Control Units and/or other Input/Output Modules and serve as a gateway to equipment furnished by others.

2. Provide the necessary quantity and types of standalone controllers to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each standalone controller shall operate completely standalone, containing all of the I/O and programs to control its associated equipment.

3. A high speed Ethernet connection to the site shall be used for offsite access to the site. Coordinate with the Owner's IT professionals for high speed system access and shall comply with Owner's requirements to maintain the level of security required by the Owner. Coordinate with Owner and provide VPN (Virtual Private Network) as required, to comply with the Owner's IT professionals requirements.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230504 – Electric Wiring

B. Section 230901 – Building Automation Control System Communications.

1.4 QUALITY ASSURANCE

A. The complete automatic temperature control system shall be comprised of electric control devices with a microprocessor based Direct Digital Control System. All work shall be installed only by skilled mechanics employed by the BACS Contractor or Subcontractor.

B. The BACS Contractor/Subcontractor shall have a minimum of five (5) years experience in systems of similar size, type and complexity installed within a 100 mile radius.

C. The BACS Contractor/Subcontractor shall have a local service department (within a 50 mile radius) and have available a minimum of three (3) factory trained technicians within a 24 hour period.

D. All components shall be fully tested and documented to operate as a complete system.

E. Supplier must guarantee that all replacement parts will be carried in stock for a period of ten (10) years minimum from the date that the system is commissioned.

F. Electrical standards: Provide electrical products that comply with the following agency approvals:

1. UL 916; Energy Management Systems for Temperature Control components and ancillary equipment.

2. UL 873; Temperature Indication and Regulating Equipment.

3. FCC, Part 15, Subpart J, Class A Computing Devices.

G. All products shall be labeled with the appropriate approval markings. System installation shall comply with NFPA, NEMA, Local and National codes.

1.5 ACCEPTABLE MAKES

A. The complete Building Management System is designed and based on that manufactured by Automated Logic Corporation. Acceptable Make: Automated Logic Corporation**.**

1.6 SUBMITTALS

A. Submit for review, a brochure containing the following:

1. Floor Plans: Floor plans shall include all controllers/control panels, sensors, interface devices, remote pressure transmitters, smoke detectors, control valves, control dampers, flow meters, UPS's, etc., and all network components (repeaters, routers, etc.). Network wiring shall be shown and identified on the floor plan drawings.

2. Control System Architecture Diagram: System architecture one-line diagrams shall indicate schematic location of all controllers, LAN switches and interface devices, gateways, etc. Indicate address and type for each control unit; as well as physical media, protocol, communication speed, and type of each LAN.

3. Control Schematic Drawings: Control schematics shall be generated to graphically indicate each functional system, show the schematic configuration of the systems and location of control devices, define the point names and addresses (as applicable), and define the setpoints for control elements. The following information shall be included in the control schematics at a minimum:

a. BACS legend and abbreviations.

b. BACS one-line Architecture diagram.

c. Point names and types.

d. Normal position of output devices.

e. Setpoints.

f. Point addresses and device ranges per Cornell Standard Section 230901.

g. Complete bill of materials listing all devices and manufacturer numbers.

4. List of all points, including alarms and trends: A listing of all input/output (I/O) points shall include all physical and virtual points, organized by system/sub-system; names, descriptors, and point types; as well as the following:

    a. Hardware & Software point type and addresses.

    b. Specific input points that must be able to be put in test mode to facilitate commissioning.

    c. Listing of any associated alarms, as well as annunciation location (BACS, EMCS, etc). Control loops shall include an adjustable deviation from setpoint alarm based upon error and time. The alarm parameters shall be the state the point is in to cause a particular alarm, including whether the source system is also enabled. Examples of points in this list are as follows:

5. Detailed written sequences of operation.

6. Submit a valve and damper scheduled showing size, pressure drop configuration, capacity, and locations. Provide apparatus Bulletins and data sheets for all control system components.

7. Product Data: The BACS vendor shall submit manufacturer's technical product data for each control device, panel, controller, and accessory furnished indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation, start-up, calibration, and maintenance instructions as well as all cable and tubing requirements.

8. Wiring Diagrams: The BACS vendor shall include detailed wiring. Indicate all required electrical wiring. Wiring diagrams shall include both ladder logic type diagrams for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on the system schematic. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed. All wiring of related components that make up a system shall be grouped together in one diagram (e.g., all wiring diagrams for the components and devices on a particular AHU shall be shown on one drawing. The supply fan components and devices shall not be shown separate from return fan components and devices, etc.).

B. Record Documents: Record documents shall be prepared reflecting the final installed condition of the BACS. These as-built documents shall be kept up to date throughout the construction and warranty period. Provide the following information for approval prior to project closeout:

1. Maintenance instructions and spare parts list for each type of control device, control unit, and accessory.

2. BACS User's Guides (Operating Manuals) for each controller type.

3. BACS Programming Manuals for each controller type.

4. All information provided during the submittal phase; updated with as-built information. As-built panel drawings shall also be included as part of the O&M manual process. The drawings that are located in each panel shall incorporate all the systems controlled from that particular panel. The drawings shall include the system schematic and detailed panel wiring diagram. The specific locations of any remote devices such as remote static pressure sensors and differential pressure sensors shall be noted on the plans.

5. Each control panel on the project shall include an as-built hard copy of all drawings and documentation associated with that panel and its field devices. This documentation shall be provided in a plastic protective pocket mounted inside the panel door.

6. As-Built Program: Databases with logic, graphics, trends, setpoints, and tuning parameters.

1.7 SCOPE OF WORK

A. Except as otherwise noted, the control system shall consist of all Ethernet Network Controllers, Standalone Digital Control Units, software, sensors, transducers, relays, valves, dampers, damper operators and other accessory equipment, along with a complete system of electrical interlocking wiring as required to fill the intent of the specification and provide for a complete and operable system.

B. The BACS Contractor/Subcontractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.

C. All interlocking, wiring and installation of control devices associated with the equipment shall be provided under this Contract. The BACS Contractor/Subcontractor shall demonstrate the operation of the system to the Owner and prove that it complies with the intent of the drawings and specifications.

D. Provide services and manpower necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative. Commissioning reports showing the testing of each BACS point on the system shall be submitted to the Engineer for review and approval upon completion of the commissioning process. Refer to the Mechanical and Electrical Commissioning Specification Section 230800 and 260800.

1.8 WORK INCIDENTAL TO BACS CONTRACTOR

A. The BACS Contractor/Subcontractor shall furnish the following materials, installation by the HVAC Contractor:

1. For piping work:

a. Control valves in piping.

b. Immersion sensing wells in piping systems.

c. Valved pressure taps.

2. For sheet metal work:

a. All automatic dampers, the BACS Contractor/Subcontractor shall assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper and motors.

b. The HVAC Contractor shall provide access doors or other means of access through ducts or ceilings and walls for service and adjustment of controllers, valves, and dampers.

B. Control manufacturer shall furnish written details, instructions and supervision for the above trades to ensure proper installation size, and location of any equipment furnished for installation by others.

C. The BACS Contractor/Subcontractor is responsible for providing 120 volt dedicated power to all BACS panels and for providing 120 volt dedicated power emergency power with surge protection to all BACS panels, where noted.

D. Electrical trade to provide occupancy sensors unless noted otherwise. Refer to responsibility matrices in Part 3.

E. The BACS to provide 120 volt dedicated power and control transformers at all microprocessor based VAV terminal unit controllers. As an option, provide control transformers sized to serve multiple VAV terminal unit controllers and laboratory air valve controllers. The Electrical Contractor is responsible for providing a junction box or boxes to obtain power, on a per floor basis. See electrical plans for locations.

F. BACS Contractor/Subcontractor is responsible for providing Ethernet data drops at main building controller and IP controllers.

1.9 SYSTEM ADJUSTMENT AND CALIBRATION

A. When the Work has been completed, completely adjust and calibrate the control system. Review the operation of each system input and output, control loops and/or software routings, timing functions, operator entered constants and facilities management functions and observe that they perform their intended functions. Provide a complete values and points log, printed every hour, for one week to demonstrate control functions and programming. Provide one point log for summer operation and one winter. Points to be trended shall be selected by the engineer. When above procedure has been completed and the control system is operating satisfactorily, submit a letter with one copy of completed values and points log to the Owner's Representative advising them that the control system is 100% complete and operates in accordance with the Contract Documents.

B. After review and approval of points log by the Engineer, the BACS Contractor shall schedule a technician on site for field review of system components, operation and graphics as part of final system appearance.

1.10 WARRANTY

A. Except as otherwise specified, the Contractor shall warrant and guarantee all work against defects in materials, equipment, and workmanship for a period of one (1) year from the date of acceptance of the work as evidenced by a resolution to that effect by the Owner, and for that period of time noted in special or extended warranties.

1. Maintain temperatures within 1°F above and below setting.

2. Humidity devices shall maintain relative humidity conditions within 3% of span 0-100% RH.

B. The period of one (1) year shall be extended with respect to portions of the work first performed after substation completion by the period of time between substantial completion and actual performance of the work.

C. The Contractor shall provide all recommended preventative maintenance of the materials, equipment, and workmanship as necessary and as described in the operating and maintenance manuals during the warranty period. In addition, the Contractor shall provide two (2) semi-annual service visits (i.e., one visit during the peak cooling season and one visit during the peak heating season) to test and evaluate the performance of the equipment. The Contractor shall provide a written report of the test and evaluation results. The service visits shall include, but not be limited to:

1. Checking and, if necessary, correcting the calibration of the sensors, transducers, and transmitters for air flow, liquid flow, pressure, temperature, and humidity.

2. Checking and, if necessary, correcting the operation of the dampers and damper actuators.

3. Checking and, if necessary, correcting the operation (i.e., monitoring and command) of the system points.

D. Software and Hardware Updates - At the end of the first six months, and during the subsequent six months, the BACS Contractor shall update the equipment and any controllers, servers, workstations, and HMI Web servers with the latest modifications and improvements in software, firmware, and hardware that the manufacturer may have incorporated in the furnished equipment.

PART 2 - PRODUCTS

2.1 SENSORS

A. Temperature Sensors / Transmitters:

1. Temperature sensors / Transmitters shall comply with the following as a minimum:

a. Resolution: When matched with A/D converter of the controller, sensor range shall provide a resolution of no less than 0.4°F (unless noted otherwise) over a range of -30 to 230°F.

b. Accuracy: +/- 0.4°F accuracy at calibration point. When used in combination with a humidity and/or CO_2 sensor, +/- 0.5°F is acceptable.

c. Element: Thermistor.

1) Outside air (OA) temperature and liquid immersion sensors: Thermistor or Integrated circuit.

2. Room Temperature Sensor:

a. These shall be an element contained within a ventilated cover, suitable for wall mounting on a standard electrical box. Provide an insulated base. Provide in white, unless noted otherwise.

b. Setpoint Adjustment: Provide set point adjustment where indicated. The setpoint adjustment shall be a warmer/cooler indication that shall be scalable via the BACS. Programmable scale shall have the capability to be limited via the BACS. Public spaces shall not have setpoint adjustment.

c. Occupancy Override: Where spaces do not have occupancy/vacancy sensors, provide a button on the room sensor enclosure where indicated. This shall be a momentary contact closure. Public spaces shall not have occupancy overrides.

d. Display: Alphanumeric.

3. Single Point Duct Temperature Sensor:

    a. These shall consist of a sensing element, junction box for wiring connections, and a gasket to prevent air leakage or vibration noise. The sensor probe shall be stainless steel.

4. Averaging Duct Temperature Sensor:

    a. These shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide sensor lengths and quantities to result in one foot of sensing element for each, two square feet of coil/duct face area. The averaging sensor tube shall contain at least four thermistor sensors.

5. Liquid Immersion Temperature Sensor:

    a. These shall include thermowell, sensor and connection head for wiring connections. Thermowell shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.

6. Outside Air Temperature Sensor:

    a. These shall consist of a sensor, sun shield, utility box, and watertight gasket to prevent water seepage. Materials shall be non-corroding and resistant to UV exposure.

B. Humidity Sensors:

1. Sensors shall comply with the following as a minimum:

    a. Input Range: 10 to 100% RH.

    b. Operating Range: As required by the application.

    c. Long Term Stability: Less than 1% drift per year.

    d. Accuracy:

        1) General Duty, monitoring: +/- 3% RH between 20-90% RH at 77 °F, including hysteresis, linearity, and repeatability.

        2) High Accuracy control, enthalpy calculation, dewpoint calculation, humidification and dehumidification control: +/- 2% RH between 20-90% RH at 77 °F, including hysteresis, linearity, and repeatability.

2. Device shall be suitable for duct, wall, or outdoor mounting. Device shall be combined into one device with temperature and CO2 sensors, where applicable. Sensors shall be two-wire transmitters utilizing bulk polymer resistance change or thin film capacitance change. Units shall produce linear continuous output of 4-20 mA for % RH. Duct sensors and outdoor air humidity sensors shall be suitable for ambient temperature conditions of -40 to 212°F.

C. Carbon Dioxide (CO_2) Sensors:

1. CO_2 measurement shall be accomplished with Non-Dispersive Infrared (NDIR) technology. Sensors shall comply with the following as a minimum:

   a. Uncertainty: Shall be no greater than ±75 ppm (or ±7% of Reading <500 ppm and ±7.5% for 800 – 1,200 ppm) at 77° F (25° C) for a CO_2 measurement range of at least 400 – 2,000 ppm.

   b. Stability: Less than 2% FS, over the expected 15 year life of the typical sensor.

2. Each CO_2 sensor node shall be factory calibrated, shall automatically self-calibrate during operation and shall not require routine recalibration throughout its normal service life.

3. Device shall be combined into one device with temperature and humidity sensors, where applicable.

D. Dewpoint Sensors – Compressed Air Dewpoint and Pressure Monitoring:

1. These shall consist of sensor, connection head for wiring connections and a gasket to prevent air leakage or vibration noise.

2. Design Make: Vaisala DPT146

3. Acceptable Manufacturer: Vaisala

E. Pressure Sensors / Transmitters:

1. Air Differential Pressure Sensor / Transmitters:

   a. Provide zero and span adjustments, measuring probes and display.

   b. Sensors / Transmitters shall comply with the following as a minimum:

      1) Accuracy: +/- 1% of full scale.

      2) Range: Smallest range feasible for the application, but no more than two times the working differential pressure of the system to allow the highest resolution possible.

c. Acceptable Manufacturers: BAPI, Dwyer, Mamac, Setra, Veris Industries.

2. Liquid Differential Pressure Sensors:

a. Three-valve manifold for venting, draining, and calibration; pressure/temperature test ports in lieu of pressure gauges. Wetted parts shall be stainless steel with a silicone fluid-filled diaphragm. Provide span and zero adjustments.

b. Sensors / Transmitters shall comply with the following as a minimum:

1) Signal: Linear 4 to 20 mA or 0-10 VDC signal.

2) Span: No greater than 2 times the working differential pressure of the system to allow the highest possible resolution.

3) Rating: 150 psig, static.

4) Accuracy: 1% accuracy over the entire span.

5) Repeatability: +/- 0.5% at maximum span.

c. Design Make: Veris Industries PWL / PWL2.

d. Acceptable Manufacturers: Mamac, Setra, Veris Industries.

3. Air Differential and Static Pressure Switches:

a. Span shall be no greater than 2 times the measured value to allow the highest possible resolution.

4. Liquid Differential Pressure Switches:

a. Do not use liquid differential pressure switches for run status on pumps. Provide liquid differential pressure switches when pressure sensing is required to determine status.

b. Acceptable Manufacturers and Model Numbers: Barksdale EPD1HAA40, Penn P74.

F. Water Flow Sensors / Transmitters:

1. Water flow sensors shall meet the requirements necessary for use for test and balance duty as defined in the specifications.

2. Service: Sub-Metering.

a. Full building utility meters needed for billing purposes shall be furnished by Cornell Utilities for contractor installation.

3. Type: Magnetic or Ultrasonic.

    a. Turbine & Annubar types are not allowed.

4. Acceptable Manufacturers and Model Numbers:

    a. Siemens – Sitrans MAG 3100 Electromagnetic.

    b. Emerson – Flexim Ultrasonic.

    c. Dwyer – Series TUF Ultrasonic.

G. Air Flow Sensors/Transmitters:

1. Air flow sensors shall be Pitot-tube averaging grid or Vortex Shedding type.

    a. Fan inlet grids shall be used where possible to measure fan flow. Fan inlet grids shall be provided by the fan vendor, where possible. BMS contractor shall provide fan inlet grid when it is not provided by fan vendor and it shall not block or affect fan efficiency.

    b. The use of “golf ball” type airflow probes is not acceptable.

    c. The use of combination control damper/flow measurement devices is not acceptable.

2. Duct Mounted Air Flow Sensor:

    a. Rectangular: 16 gauge galvanized casing, 8 in. deep, with formed 1-1/2 in. integral 90° connecting flanges.

    b. Oval: 18 gauge galvanized casing, 8 in. long between beads with 1 in. connecting sleeve on each end (10 in. overall length). Actual O.D. dimensions are 1/4 in. less than specified duct I.D. dimensions.

    c. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

    d. Temperature: 350°F continuous operation, 400°F intermittent operation.

    e. Humidity: 0-100% continuous operation.

    f. Corrosion Resistance: Good salt air, excellent solvent and aromatic hydrocarbon resistance.

    g. Element Material: 6063-T5 anodized aluminum.

    h. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

i. Acceptable Manufacturers: Accutrol Vortek, Air Monitor, Paragon

3. Fan Inlet Air Flow Stations:

a. Material: 6063-T5 anodized aluminum, galvanized mounting brackets.

b. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

c. Temperature: 350°F continuous operation; 400°F intermittent operation.

d. Humidity: 0-100% continuous operation.

e. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

f. Corrosion Resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance.

g. Design Equipment: Paragon Controls FE-1050.

h. Acceptable Manufacturers: Accutrol Vortek, Air Monitor, Paragon

4. Outside Air Flow Station:

a. Material: Element 6063-T5 anodized aluminum and casing 16 gauge G90 galvanized steel.

b. Accuracy: Within ± 0.5% of actual flow through the velocity range of 200 to 12,00 fpm when installed in accordance with published recommendation and within ±5% at a velocity of 100 fpm. Operating velocity range 100 to 2,800 fpm.

c. Temperature: 350°F continuous operation and 400° intermittent operation.

d. Humidity: 0 to 100%.

e. Acceptable Manufacturers: Air Monitor, Paragon

5. Air Volume/Velocity Transducers for Duct, Outside Air and Fan Inlet Airflow Stations:

a. The transducer shall be a combination differential pressure transmitter, square rood extractor, scaling multiplier, and output filter with process indication, complete in a single package Transducer shall comply with the following as a minimum:

1) Accuracy: +/- 0.25%.

2) Stability: +/- 0.5% of full scale per year or less.

3) Span: No greater than 2 times the working differential pressure of the system to allow the highest possible resolution.

4) Material: Compatible with the environment.

5) Auto-zero capability by venting ports to atmosphere.

b. The measured air volume shall be locally indicated on a door mounted LED display meter scaled in CFM.

c. The transducer package shall be a factory calibrated for the flow-measuring element being served.

d. A transducer shall be provided for each individual airflow station.

e. An output signal of 0-10 VDC or 4-20 mA shall be generated for monitoring by the BACS system.

f. Acceptable Manufacturers: Accutrol Vortek, Air Monitor, Paragon.

H. Current Switches (CS):

a. For constant speed motors, switch shall indicate loss of status when current falls below an adjustable trip point.

b. CS shall include LED indication of status.

c. Acceptable Manufacturer: Veris Industries.

I. Occupancy/Vacancy Sensors:

1. For spaces with standalone lighting controls, the sensors are to be provided by the electrical trade to control both HVAC and lighting; The BACS contractor shall provide a single gang box with face plate at the sensor. Refer to the Lighting Controls Responsibility Chart in Part 3.

J. BACS Lighting Control Sensors:

1. Certain zone types require that the BACS perform the lighting controls. Refer to Division 26 specifications for the product requirement and refer to the BACS Lighting Controls Responsibility Matrix in Part 3.

K. Condensate Sensors:

1. Condensate Sensors for moisture sensing on chilled water supply systems to terminal chilled beam and radiant cooling devices.

2. Acceptable Manufacturers and Model Numbers:

    a. Siemens QXA 2000

    b. Sauter EGH 102

    c. Honeywell H7018A1003

L. Break Glass Wall Plate Station:

1. Stainless steel wall plate break glass with hammer and chain. Operator is maintained depressed by glass and extends to normal position when glass is broken.

2. Unit shall mount on standard, single gang box. Unit shall be flush-mounted, if possible. In locations where surface mounting is required, gang box shall be red and maximum of 2 in. deep.

3. Custom Label: EMERGENCY HVAC SHUT-OFF

4. Provide contact block with one normally open and one normally closed contact blocks.

5. Provide three spare lens.

6. Design Make: Pilla Electrical WPSBR.

7. Acceptable Manufacturers: Pilla Electrical.

M. Quality Water System:

1. Acceptable Manufacturers and Model Numbers:

    a. Dwyer DFMT2 Flow Transmitter

    b. Blue-White F-2000 Molded In-Line Flow Transmitter

    c. RealTech Controls ETX Conductivity/Resistivity Transmitter

N. Safety/Status Devices:

1. Low Limit Detector: Electric type, with 20 ft. long serpentine element, with manual reset and auxiliary contacts to the BACS, set for 37°F for "freeze" protection and 55°F for fan discharge application. Provide a 20 ft. long element for every 25 sq. ft. of coil face area.

2. High Limit Detector: High limit thermostats shall be located as directed, and shall be manual reset type set at 120°F in the return and 180°F in the discharge. Thermostats shall be double pole so as to provide input capability for alarm at the temperature control system.

3. Pump status shall be provided through adjustable range current sensing element on pump motor.

4. Fan status shall be provided through adjustable range current sensing element on the fan motor.

O. Miscellaneous Devices:

1. Provide necessary, relays, transformers, required for a complete and operable system.

2.2 CONTROL VALVES

A. General:

1. Sized by BMS Contractor/Subcontractor and guaranteed to meet the heating and cooling requirements. Pressure drop for valves shall be submitted for review, including all CV values. Valves shall be selected such that they are not oversized.

2. Valves shall be suitable for the rated pressure and temperature service. Close off pressures must be determined in concert with the actuators and valves shall be provided to close off against extreme anticipated conditions.

3. Modulating valves shall be carefully selected to control in a smooth and stable fashion across the range of anticipated conditions. Split ranging of heating and cooling valves controlled by the BACS is not acceptable. A separate output from the BACS shall be provided for all control valves. Electric Input shall be 4-20 mA or 0-10 VDC.

4. Pressure independent control valves shall not be used.

B. Electrical Operators:

1. Provide 24 VAC control operators which are 0-10 VDC input proportional with fail positions as noted below and as needed by control sequence. Operator shall be synchronous motor driven with sufficient reserve torque to provide smooth modulating action.

2. Actuators shall be electric, one motor only. When stacking of actuators is deemed necessary, actuator shall be submitted for review by engineer of record and owner.

3. Acceptable Manufacturer: Belimo

C. Steam:

1. Steam control valves have a flanged or screw body with a rating of 400°F or higher, as appropriate. Trim shall be rated for 400°F.

2. High performance segmented V-ball control valves shall be used for all steam control applications. Steam valves shall have the following characteristics:

   a. Leakage Class: ANSI Class IV, minimum.

   b. Flow Characteristic: Equal Percentage.

   c. Rangeability: 300:1 turndown.

   d. On steam control valves with a normal differential pressure of 15 psig or greater, stainless steel noise reducing trim shall be used.

3. Valve shall be sized for no more than a 5 psig pressure drop, or 30% (max.) of design steam pressure, whichever is smaller.

4. Fail positions shall generally be as follows:

   a. Heat Exchangers/Converters: Normally closed, spring return (to protect for high temperature).

   b. Clean Steam: Normally closed, spring return.

   c. Humidifiers: Normally closed, spring return.

5. Acceptable Manufacturers: Bray, Fisher, Neles, Valve Solutions, Inc.

D. Chilled Water Recirculating Loop Valve (Two-Way):

1. Type: Rotary-segmented ball ported industrial control valve.

2. Body: Flanged carbon steel.

3. Seat: Composition or stainless/ teflon.

4. Leakage Class: ANSI Class IV, minimum.

5. Trim: 316 stainless steel.

6. Flow Characteristics: Equal percentage or modified equal.

7. Typically CV shall be selected to give a 2 PSIG drop @ maximum building flow with the valve at the 90% open CV. Verify the necessary pressure drop with the engineer and Cornell University Department of Utilities and Energy Management (Utilities). For buildings located at extremities, requirements may not be typical.

8. Valve shall seat against 40 PSI differential pressure (typical value; check with Cornell Utilities for location specific values).

9. Fail Position: Fail Last

10. Acceptable Manufacturers: Belimo, Fisher, Neles, Valve Solutions, Inc.

E. Coil Valves, Water:

1. Type: Two-way, V-port valve with characterizing disc, 1/4 turn.

2. Packing: EPDM O-rings, lubricated.

3. Ball & Stem: Stainless steel.

4. Seat: Fiberglass reinforced teflon.

5. Flow characteristics: Equal percentage

6. Modulating water valves will generally be ball valves with an equal percentage characteristic. Modulating water valves shall typically be sized for 50-100% of the typical controlled circuit pressure drop at 70% wide open CV. The minimum design CV shall be no less than 1.9.

7. Water and glycol control valves shall be rated to remain closed (zero leakage) against 120% of the full shutoff head of the pumps, when the control signal is set to "fully closed".

8. Fail positions shall generally be as follows:

   a. Terminal Hot Water Radiation: Fail last.

   b. Duct Mounted Re-heat Coils Serving Animal Rooms: Normally closed, spring return.

   c. Duct Mounted Re-heat Coils Serving Laboratories: Fail last.

   d. Duct Mounted Re-heat Coils Serving Offices: Fail last.

   e. Fan Coil Unit Cooling Coils: Normally closed, spring return.

   f. Pre-heat Coils in Air Handling Units: Normally open, spring return.

   g. Chilled Water Coils in Air Handling Units: Normally closed, spring return.

   h. Chilled Beam Terminal Cooling: Normally closed, spring return.

9. Acceptable Manufacturers: Belimo, Valve Solutions, Inc.

2.3 CONTROL DAMPERS

A. General:

1. Dampers shall be applicable for the rated pressure and velocity service. Damper structural rating shall exceed extreme anticipated conditions like fan deadhead.

2. Where damper sizes are not specifically indicated, they shall be sized by the BACS Contractor. Maximum velocity shall be 1500 fpm and maximum pressure drop 0.1 in. w.g.

3. Modulating dampers shall be carefully selected to control in a smooth and stable fashion across the range of anticipated conditions.

4. Except where size dictates a single blade, dampers shall always be opposed blade.

5. When a large section of damper is to be connected to a single jackshaft, size limitations shall be followed. This will prevent excessive damper area or, more importantly, length from being connected to a single jackshaft. Typically, the manufacturer's recommendation shall be sufficient for specifying a limit to the size of a damper bank that may have field fabricated jackshaft connections.

6. Whenever possible, dampers shall have external crankshafts to allow the connection of the damper actuator outside of the air stream. This will allow for easier access to the actuators for maintenance.

7. Output to modulating control dampers shall be analog.

B. Electrical Operators:

1. Provide 24 VAC control operators which are 0-10 VDC input proportional or two position with spring return as needed by control sequence and designed to operate the control dampers. Operator shall be synchronous motor driven with sufficient reserve torque to provide smooth modulating action or two position action and adequate close off rating.

2. Actuators shall be electric, one motor only. Stacking of actuators is unacceptable. Design for a minimum of 60,000 full cycles at full torque and listed to UL 873. Provide stroke indicator. Actuators shall have a positive positioning circuit and selectable inputs. Full stroke shall be within 90 seconds. Where fail positions are required, provide spring return on the actuator with adequate close off force.

3. Acceptable Manufacturer: Belimo

C. General Duty, Control Dampers:

1. Provide control dampers as shown on the drawings and diagrams, to meet the following minimum construction standards.

2. Leakage: Class 1, 4 CFM/sq. ft. at 1 in. W.C., tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage.

3. Frame: 16 gauge galvanized steel structural hot channel with tabbed corners for reinforcement to meet 13 gauge criteria.

4. Blades: 14 gauge (equivalent thickness galvanized steel) roll forward air foil type for low pressure drop and low noise generation. Blades shall be parallel for two-position dampers and opposed, for modulating dampers.

5. Blade Seals: Ruskiprene, suitable for -72°F to +275°F mechanically locked into the blade edge.

6. Jamb Seals: Flexible metal, compression type.

7. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.

8. Bearings: Corrosion resistant, permanently lubricated stainless steel sleeve.

9. Dampers subject to corrosive fumes or humidity shall be constructed of stainless steel.

10. Dampers over 48 in. length and height shall be made in multiple sections.

11. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package.

12. Design Make: Ruskin CD60.

13. Acceptable Manufacturers: Greenheck, Ruskin and Tamco.

D. High Performance Thermally Broken and Insulated Control (Motorized) Dampers:

1. Provide high performance thermally broken and insulated control dampers at outdoor air intake and exhaust louvers to meet the following minimum construction standards.

2. Leakage: Shall not exceed 4 CFM/sq. ft. at 1in. W.C. (Leakage Class 1), tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage. Holding torque shall not exceed 5 in. lbs./sq. ft. on opposed blade dampers, and 7 in. lbs./sq. ft. on parallel blades with a minimum torque of 40 in. lbs.

3. Frame: 0.125 in. extruded aluminum structural hat channel with tabbed corners for reinforcement.

4. Blade Seals: Ruskiprene II, suitable for -40°F and with locked into the blade edge extruded silicone, down to -70°F.

5. Jamb Seals: Flexible polycarbonate type.

6. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.

7. Bearings: Corrosion resistant, permanently lubricated molded synthetic.

8. Dampers over 48 in. length and height shall be made in multiple sections.

9. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package.

10. Design Make: Ruskin TED50.

11. Acceptable Manufacturers: Greenheck, Ruskin and Tamco.

2.4 CONTROL PANELS

A. Enclosures:

1. BACS control panels shall be fully enclosed cabinet, baked enamel, steel, aluminum or composite material construction. Enclosures located in mechanical rooms shall be NEMA 4 and Enclosures located in labs and other relatively dust free and dry spaces may be NEMA 1. Enclosures shall have removable back plates and keyed, hinged covers. Enclosures shall be either free-standing or wall-mounted. Provide support steel framing.

2. The Contractor shall size the panel such that no more than 80% of the surface of the enclosure back plate is used.

3. Network level boards shall be installed inside a protective enclosure.

4. Plastic wire way (e.g., Panduit) shall be used to organize all wiring in the panel. Sufficient wire way shall be provided in the panel such that it is filled no more than 80% capacity.

5. Cover exposed electrical connections. Each component on front panel shall have an appropriate engraved label describing its function. Components inside the panel shall be appropriately labeled for ease of identification. Stick-on labels are not acceptable.

B. Low Voltage Power Supplies:

1. The Contractor shall provide a regulated, protected low voltage power supply as required with the ability to produce at least 33% more current than required by the transmitters and controls being installed. Output regulation shall be less than 0.5mV. There shall be no overshoot on turn on or off. Operating temperature shall be -20 to +70ºC.

2. Class II transformers shall be used.

C. Line Voltage Power Source:

1. Careful consideration must be given to the propagation of information across controllers as they wake up from a power interruption. This may require certain critical controllers to be powered from uninterruptible power source (UPS) to ensure rapid propagation of the emergency status.

2.5 CONTROL WIRING AND INSTRUMENTATION TUBING

A. All control wiring shall comply with requirements of "Electrical Wiring" in Section 230504.

B. All instrumentation tubing in mechanical rooms shall be hard drawn type L copper.

2.6 CONTROLLERS

A. The control system shall consist of a network of controllers. It is intended to allow cost-effective application of manufacturers' standard products while maintaining the integrity and reliability of the control functions commensurate with their application. The controllers provided shall meet the performance requirements for throughput, response time, point capacity, trend log capacity, etc., as stated in this section and Section 230901. While specification 230901 contains several constraints on the controller system architecture, it is recognized that a variety of configurations may be equally acceptable. For example, it may be possible to meet the project requirements with a single large controller or several smaller ones. Therefore, this guideline does not generally prescribe controllers' system architecture or controllers' detailed characteristics, such as processor speed, amount of memory, amount of I/O, power supply details, etc.

B. Controllers shall be provided with a real-time operating system resident in ROM. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. At a minimum, the following shall be provided:

1. Real-time operating system software.

2. Real-time clock/calendar and network time synchronization (with the exception field-level controllers).

3. Controller diagnostic software.

4. BACS software.

5. Alarm processing and buffering software.

6. Energy management software.

7. Data trending, reporting, and buffering software.

8. I/O (physical and virtual) database. Inputs and outputs shall have the capability to be overridden for emergency modes and testing. If the design documentation does not specifically indicate for which points this is required, control vendor shall request in writing a list of such points. If this has not been requested, the vendor shall reprogram or reconfigure the systems as required during testing.

C. Building and system level controllers (for example, air handling units, hydronic systems, laboratory zones) shall be capable of operating independently, in stand- alone fashion, with no communication to other devices on the network while performing their monitoring and control routines using programs and operating parameters stored in the controllers' memory. All points and functions that make up a functional system shall be included in one controller to qualify for this stand-alone functionality. Refer to control schematics for function point groups. Examples of required functional point groupings, by owner, are as follows:

1. Air Systems: All points and functions required to control an air handler with all directly associated supply fans, return fans, exhaust fans, airflows, heat recovery, coils and downstream static pressure sensors. This excludes the terminals that may be associated with that air handler.

2. Hydronic Systems: All points and functions associated with the supply side of a hydronic system such as pumps, flow meters, temperature sensors, differential pressure sensors, proof indications, valves etc. This excludes the terminals on that hydronic system.

3. Terminals: All points and functions required to control one terminal system including variable airflow devices, control dampers, valves, temperature and humidity sensors, etc. This does not include the scheduling period or any outside air that may be necessary for control.

D. Where control sequences depend on global variables such as outside air temperature, the controller shall have the capability of either using the last value or a default value.

E. Values that may be received across the network are as follows:

1. Air Systems: Outside air temperature and humidity, emergency power source indications, terminal based reset parameters, VAV box commands, smoke modes.

2. Hydronic Systems: Outside air temperature and humidity, emergency power source indication, and terminal based reset parameters, control valve commands.

F. Controllers must include sufficient memory for all required operation and all required trending, when trending is buffered in the controller. Where control system operation is hindered by the shortage of memory, contractor shall, at no cost to the Owner, either upgrade the memory or provide multiple controllers. The mix of points for multiple controllers shall not violate the stand-alone requirements.

G. Controllers storing their configuration in volatile memory shall not be used. Software stored in non-volatile memory will not have to be downloaded from the central server after an interruption of power occurs.

H. Controllers used for time-scheduled operations must be equipped with a battery backed internal real-time clock function to provide a time base for implementing time-dependent programs. Provision shall be made for the automatic updating, such as a Network Time Protocol (NTP) server or Precise Time Protocol (PTP) server, of the controllers' clocks via a time master.

I. Resumption of power after an outage shall cause the controllers to automatically restart and establish communications as needed by their applications. Controller shutdown based on a self-diagnosed failure in the power supply, hardware, or software must set each piece of controlled equipment to a predetermined failure mode.

J. Controllers shall be powered from the most reliable source that powers any of the systems it serves. In the situation where a controller will be required to continuously collect data, or where it monitors critical recovery information such as the presence of emergency power, it may be necessary to provide a UPS for the controller as well as any critical sensors. Where panels are provided with a UPS, the panel shall be provided with a means of monitoring the power source status to the controlled equipment to enable special emergency power logic. This can be a dedicated power monitor or a value coming from transfer switch contacts.

K. Controllers shall be powered from the most reliable source that powers any of the systems it serves. In the situation where a controller will be required to continuously collect data, or where it monitors critical recovery information such as the presence of emergency power, it may be necessary to provide a UPS for the controller as well as any critical sensors. Where panels are provided with a UPS, the panel shall be provided with a means of monitoring the power source status to the controlled equipment to enable special emergency power logic. This can be a dedicated power monitor or a value coming from transfer switch contacts.

PART 3 – EXECUTION

3.1 GENERAL SYSTEM REQUIREMENTS

A. This section defines the requirements for configuration and installation of the BACS.

B. Vendors providing controls for Cornell University shall maintain site-wide configuration documentation. Whenever the BACS is extended, the documentation required in this section shall be provided/updated per configuration management requirements to reflect the entire installation on the campus.

Device naming and addressing must conform to Cornell's specific conventions as detailed in Cornell's specific convention as detailed in Specification 230901. No device will be connected to a Cornell network until these conventions have been understood and met.

C. Devices (i.e., sensors, meters, instruments, etc.) that are resettable must be installed in a readily accessible location (e.g., the device must be accessible at floor level without the use of a ladder). No device shall require shutting down a building system for calibration.

D. Devices that are installed in an exposed location (i.e., not mounted within a cabinet) must be suitable for such installations (e.g., do not install a device that is intended to be installed in a cabinet in an exposed location).

E. Remove all obsolete pneumatic tubing and control devices.

3.2 SENSORS

A. Room Sensors shall be mounted symmetrical with adjacent items such as light switches (nominally 44 inch to the center of the device and in accordance with ADA requirements). Verify exact room location to avoid doors, fixed and portable equipment. Install to minimize damage. Do not install adjacent to lighting dimmers or other heat generating equipment.

B. All sensors and transmitters shall be located in accessible locations that do not require system shutdown for calibration. Locate all remote transmitters in control panels 5 foot above finished floor.

C. One outside air (OA) temperature / humidity sensor with a global networked point provided for each building. Generally, these shall be located on a north wall of the building and installed with stand-offs. On each 100% OA system, locate sensor with dewpoint calculations in outside air intake plenum.

D. Refer to drawings for installation requirements for liquid differential pressure sensors.

E. All pressure switches shall be mounted in accessible and, to the extent possible, vibration-free locations. Switches shall be installed in accordance with the manufacturer's installation instructions.

F. Do not use liquid differential pressure switches for run status on pumps. Current switches shall be used on constant volume pumps and drive contacts shall be used for pumps with ASDs.

G. Flow sensors shall be carefully placed to ensure flow profiles that are required for accurate flow sensing. Installed in accordance with the manufacturer's installation instructions for minimum length of duct or pipe unobstructed upstream and downstream from the sensor.

3.3 CONTROL VALVES

A. Union or flanged connected. Locate close to apparatus controlled with pipe reducers and increasers located closest to valve. Locate, arrange, and pipe per installation diagram.

3.4 CONTROL DAMPERS

A. Dampers and Damper Operators: Tag dampers for proper location. Install per manufacturer's printed instruction as to motor size and quantity, linkage arrangement, drive connection point. Adjust to close tightly. Allow for conduit sleeve or blank space for roof fan dampers. Where ducts are insulated, set damper operators at least 2 in. away from side of duct to allow for insulation.

3.5 CONTROL PANELS

A. The control panels and enclosures housing the controllers shall be coordinated to the extent possible, to share vertical and horizontal wire-ways to facilitate and minimize the cost of home-runs to terminal equipment.

B. Cornell must have quick, direct access to all control panels to maintain building integrity similar to that provided for fire emergencies without going through user spaces. Panels shall be located outside of user areas where practical. If field panels must be located in user areas, they shall be in areas with easy access. Protection and separation for user activities will be provided.

C. Enclosures:

1. All BACS mechanical room control panels shall be installed in metal enclosures containing the controller, I/O modules, power supplies, termination strips, battery (if not integral to the controller or I/O module) and a spare AC outlet.

2. Control panels shall be located in the equipment rooms, where practicable, and in locations such that the ambient conditions are between 50 and 90°F and 10 to 85% relative humidity. Control panels located in areas where conditions are outside of these ranges shall have enclosures outfitted with heating or cooling devices to provide the proper environmental conditions.

3. All terminal controllers shall be installed in a protective sheetmetal enclosure. Coordinate with the terminal unit vendor.

4. All penetrations of the BACS or outboard gear panels in mechanical rooms shall be from the bottom of the enclosure with wireway and conduit stubs from the wireway up to the panel.

5. Panel layout and construction shall be neat and professional.

6. All controllers, wiring, and components in the panels shall be labeled. All labeling shall match the reference numbers on the cabinet drawings that shall be provided for each panel.

7. All transformers and power supplies shall be mounted outside of the central panel.

D. Low Voltage Power Supplies:

1. The BACS Contactor shall certify, in writing, at the time of shop drawing submittal that the BACS equipment provided will not cause, as a result of its operation, either directly or indirectly, electrical interference to be induced into the building's electrical power systems.

E. Live Voltage Power Source:

1. Controllers shall be powered from emergency power sources whenever the controlled equipment is connected to emergency power source.

2. An un-interruptible power source (UPS) shall be provided on Ethernet network gateways (headends) and switches.

3. Line voltage power sources to controls shall be labelled with its source panel and circuit number.

3.6 CONTROL WIRING AND INSTRUMENTATION TUBING

A. All control wiring shall comply with requirements of "Electrical Wiring" in Section 230504.

B. It is extremely important that pneumatic tubing be properly terminated. Tubing shall be removed completely back to the main. Copper tubing shall be terminated with soldered end cap; poly tubing shall be terminated using brass plugs. Bending over copper tubing, pinching/brazing, and the use of sheetmetal screws to make terminations are not acceptable.

3.7 CONTROLLERS

A. The controllers and system architecture shall be configured and programmed to carry out the sequences of operation contained in the project documents.

B. Since these guidelines with respect to controllers are performance oriented, rather than prescriptive, they will generally refer simply to "controllers" meaning computers capable of direct digital control. In those cases where distinguishing between controllers with differing capabilities is needed, the following nomenclature will be used:

1. Building-level controller: These are controllers that are connected to the campus backbone network and communicate over Ethernet using BACnet/IP.

They will typically be used to control and monitor one or more large systems or be applied to other building-wide functions. They shall, at a minimum, meet the requirements of a BACnet Building Controller (B-BC).

2. System-level controller: These controllers will also be BACnet/IP connected to the campus backbone network. They will typically be dedicated to the control of a single large piece of equipment such as an air handler or chiller, and a lab environment with fume hoods. They shall, at a minimum, meet the requirements of a BACnet Advanced Application Controller (B-AAC).

3. Field-level controller: These controllers are typically used for control of "unitary" devices such as VAV boxes, fan coil units, etc. These controllers will be BACnet/IP connected to the campus backbone network or in special spaces may be on a lower performance BACnet LAN such as MS/TP or ARCNET. They shall, at a minimum, meet the requirements of a BACnet Application Specific Controller (B-ASC).

C. Programming: The programming shall be logically segmented, documented, and titled, and expand on the specified sequence of operations. Each segment shall contain control logic for a specific controlled component of a system. This is to improve the ability of the end user to understand and interpret the logic easily.

D. Trending: To support commissioning and building data mining, the BACS shall be capable of trending and archiving all points on building-level and system-level controllers at a minimum of 15 minute intervals. The BACS shall also have the capability of trending at least five points on each field-level controller at an interval of 15 minutes. The trend data shall be uploaded to a central database as needed to prevent buffer overflow in the controller. Controller memory capability, network architecture, and communications bandwidth shall be designed to account for this trending. The BACS vendor shall provide control trends during start up and prior to functional performance testing of the systems. Reports shall be scheduled to output the data to a common format such as comma separated text, Microsoft formats such as Excel and Access, and portable database format. Trended data will be archived in an Owner-accessible SQL database for a minimum period of 2-years.

E. Trend Graphs: Web-based software shall provide for displaying graphic plots of the trended values. The software shall support multiple scales, points and point types simultaneously. Control vendor shall configure these graphs in a logical manner for each system. Consult with the commissioning team members and project manager for required configuration. Provide a trend for every analog control loop that includes the setpoint, process variable, and control output.

F. Real-time Plotting: Software shall be provided for real time plotting/graphing of multiple values in user-defined time intervals. These graphs will typically be used in commissioning to observe loop responses and system reactions. Control vendor shall configure these graphs in a logical manner for each system. Consult with the commissioning team members and project manager for required configuration.

G. Web-based Graphic: The following screens shall be provided:

1. Floor Plan Screens:

a. Provide floor plan screens for each floor and/or section of the building. Indicate the location of all equipment that is not located on the equipment room screens. Indicate the location of temperature sensors and the device associated with each temperature-controlled zone (i.e., reheat coils, VAV terminals, fan-coils, single-zone AHU's etc.) on the floor plan screens. Each floor plan screen shall show thermographic space temperatures and lighting on/off status.

b. Display the space temperature point adjacent to each temperature sensor symbol. Indicate room numbers as provided by Cornell University. Provide a graphic link from each zone and/or equipment symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.

c. Provide floor plan screens for each mechanical equipment room and, if mechanical equipment is situated there, the roof. Indicate the location of each item of mechanical equipment. Provide a link from each equipment symbol shown on the plan view screen to each corresponding mechanical system schematic graphic.

d. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link the graphic building key plan to larger scale partial floor plans. Provide links from each larger scale floor plan graphic to the building key plan and to each of the other graphic floor plan screens.

e. Provide a graphic site plan with links to and from each building graphic.

f. Locate central system static and differential pressure sensors, linkable from the floor plan drawings.

2. System Schematic Screens:

a. Provide graphics for each air handling system. Indicate OA temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down, etc.). Link screens for air handlers to the heating system and cooling system graphics Link screens for supply and exhaust systems, if they are not available in a single graphic.

b. Each I/O point in the project shall appear in at least one graphic. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc., as applicable. General layout of the system shall be schematically correct. I/O devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value.

Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the cursor. Indicate all adjustable setpoints on the applicable system schematic graphic or, if space does not allow, on a supplemental linked setpoint screen. All outputs shall be represented in terms of percent open and include a pop-up link to the control logic.

c. Provide a system schematic graphic for each HVAC subsystem controlled.

d. Provide a graphic for each hydronic system.

e. Link screens for heating and cooling system graphics to utility history reports showing current and monthly energy usage, demands, peak values, etc.

f. Link screens to all schedules and setpoints.

3. Zone Schematic Screens, HVAC:

a. Provide a graphic for each zone, including all terminal units such as fan coil units, chilled beams and VAVs shown on the graphic even if provided with different terminal level controllers.

b. In addition to points associated with the unit, indicate mode of operation as applicable (i.e., normal occupied, unoccupied, warm-up, maximum heating, maximum cooling, etc.). Provide links between the applicable floor plan screen and this screen.

c. Provide links to the graphics representing the parent systems.

4. Zone Schematic Screens, Lighting Controls:

a. Provide a graphic for each zone. Provide links between the applicable floor plan screen and this screen. Refer to Cornell University Standard, 260923 for additional requirements.

H. Alarm Programming: Alarms shall be intelligent based upon the algorithm in this section

1. Alarm programming related to BACS controlled equipment shall reside at the controller level along with the functional programming for equipment control.

a. Intrinsic alarming associated with AI, AV, BI or BV objects (or any of the other BACnet objects that support intrinsic alarming) shall only be used where the alarm is valid regardless of the state of the associated equipment or where there is a ready means for automatically suppressing alarm generation when the associated equipment is operationally secured.

b. Alarm points shall be separate BACnet objects actuated by associated alarm programming.

c. Alarm objects shall have descriptive BACnet object names. BACnet alarm object names shall end in “Alarm”. For detailed information on proper point naming conventions, see Section 230901 Building Automation and Control System Communications and Interoperability.

d. If it is necessary for the alarm to have latching functionality, the user shall be provided easy unlatching capability from within the BACS system if appropriate, taking into account equipment safety concerns. This is in addition to any local alarm reset.

e. Alarms designated for monitoring by EMCS shall be set up in the BACS system to report to the EMCS alarm server.

f. Generally, only central system alarms shall be annunciated at EMCS. Zone and or equipment alarms shall be considered on a case by case basis.

2. Analog Deviation Alarms: Analog deviation alarms shall be based upon the comparison between the controlled variable and the controlled variable setpoint (whether calculated or fixed).

a. When controlled variable deviates from setpoint above or below user adjustable high or low alarm thresholds, the alarm shall be activated.

b. High and low alarm threshold values shall have associated adjustable deadbands (hysteresis values) for alarm clearing conditions as the controlled variable falls below the high alarm threshold or rises above the low alarm threshold.

c. Alarm programming shall include user adjustable alarm delays for active equipment operation.

d. Alarm programming shall include startup delays to prevent nuisance alarms during equipment startup.

e. Analog deviation alarms shall be disabled if the associated equipment is operationally secured.

3. Analog High Limit Alarms: Analog high limit alarms shall be based upon the comparison between the controlled variable and a user adjustable high limit alarm value.

a. When controlled variable rises above the user adjustable high limit, the alarm shall be activated.

b. High alarm limit value shall have associated adjustable deadband (hysteresis value) for alarm clearing condition as the controlled variable falls below the high alarm limit.

c. Alarm programming shall include user adjustable alarm delays.

d. High limit alarms shall be disabled if the associated equipment is operationally secured, unless needed due to equipment safety considerations.

4. Analog Low Limit Alarms: Analog low limit alarms shall be based upon the comparison between the controlled variable and a user adjustable low limit alarm value.

a. When controlled variable falls below the user adjustable low limit, the alarm shall be activated.

b. Low alarm limit value shall have associated adjustable deadband (hysteresis value) for alarm clearing condition as the controlled variable rises above the low alarm limit.

c. Alarm programming shall include user adjustable alarm delays.

d. Low limit alarms shall be disabled if the associated equipment is operationally secured, unless needed due to equipment safety considerations.

5. Binary Run Status Alarms: Status alarms shall be based upon the comparison between run status and equipment command where applicable.

a. Alarm Status programming shall include user adjustable alarm delays.

6. Binary Alarming: Alarms shall be triggered upon associated BI changing state to the non-normal or alarm state.

a. Alarm Status programming shall include user adjustable alarm delays.

b. Binary alarms shall be disabled if the associated equipment is operationally secured, unless needed due to equipment safety considerations.

3.8 OPERATOR INTERFACES

A. All interface to the BACS shall be web-based.

B. During construction, the BACS shall be hosted on a construction server and transferred to the owner’s central server at the earliest convenience.

C. The project shall be responsible for upgrading the campus central server location.

3.9 LOW AND HIGH LIMIT SAFETY FUNCTIONS

A. Provide for where noted on drawings. Wiring to be directly to the motor starter. High limit controller (firestat) shall be located in the unit discharge. Low limit shall be strung on the upstream face of cooling coils.

3.10 FIRE/FAN SHUT DOWN

A. Division 26 "Electric" to provide a signal to stop air handling unit fans upon activation of the fire alarm system. Wiring to be directly to the motor starter.

3.11 COMMISSIONING

A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems meet the Owner's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.

B. All new BACS installations and expansions of existing systems shall be fully commissioned. All acceptance testing, documentation and training shall be required.

C. The BACS Trade's responsibilities for commissioning and check-out include the following:

1. Ensure that the start-up, testing, adjusting, and balancing of systems and equipment has been completed prior to field commissioning.

2. Provide all logic, graphics, and trends for review prior to the start of field commissioning activities.

3. Provide a complete calibration and operational check for each individual point and function contained within the BACS.

4. Conduct the checkout with the use of point/function log sheets to be prepared by the contractor. The Owner shall approve the log sheet format.

5. Submit log sheets to the Owner prior to the commencement of any final acceptance testing.

6. Certify, in writing, to the Owner prior to the commencement of final acceptance testing that all components of the BACS are functioning as per the requirements of the contract documents.

7. Provide to the Owner as-built drawings and documentation at least four (4) weeks prior to the commencement of any final BACS acceptance testing. Ensure all trends and graphics are completed and approved by Cornell.

8. The BACS contractor shall issue a report upon project completion stating that the system is complete, has been adjusted, and has had all hardware and software functions verified, that all analog control loops are tuned, and is operating in accordance with the specifications. Any deviations from specified settings or operations necessitated during system adjustment shall be specifically noted.

9. The Contractor shall check out the installation with a representative from Cornell's Energy Conservation Control Team. The checkout shall consist of verifying the ability of the BACS to communicate with the central EMCS system, verifying the calibration of each sensor and/or transmitter, and verifying the operation of each control point.

10. All software processes shall be thoroughly demonstrated to the Owner's representative. Alarm conditions shall be simulated for conformance. Analog control points shall be exercised through their entire range. All control interlocks and sequences shall be completely verified. The checkout shall be a thorough and exhaustive review of the installation to assure proper operation of the total system.

3.12 TRAINING

A. Upon completion of the work and acceptance by the Owner, factory representatives of the control manufacturer shall provide instruction to the Owner's operating personnel who have responsibility for the mechanical systems and controls installed by the contractor. The contractor shall provide 56 hours of training.

B. The contractor shall make available to the Owner regular, scheduled training courses for ongoing training of the Owner's operating personnel. Programs shall include hardware- and software-oriented courses as well as energy conservation and management courses.

C. In addition to the normal training listed above, vendors will be required to provide one week of training at the BACS manufacturer's training facility for four people.

3.13 CONTROL SEQUENCE

A. Refer to plan for control diagrams, sequence of operation and points lists.

3.14 LIGHTING CONTROLS RESPONSIBILITY MATRIX

A. The following chart outlines the BACS / Division 26 Responsibilities with regard to the standalone lighting controls:

STANDALONE LIGHTING CONTROLS RESPONSIBILITY MATRIX

LIGHTING CONTROL DEVICE	BACS	DIV 26
Emergency Switched 277/120 VAC Power		X
120 VAC Power		X
Emergency Lighting Control Unit		X
Emergency Lighting Transfer Switch		X
Emergency Light Fixture		X
Emergency Lighting Dimming Override		X
Normal Power Light Fixture		X
Controller		X
24 VAC Power		X
Transformer		X
Primary Power Pack Relay		X
Secondary Power Pack Relay		X
HVAC OCC/UNOCC COMMAND	X	
Dimming Wall Switches		X
Dimming Control Relay		X
Occupancy Sensors		X
OCCUPANCY	X	
Daylight Sensors		X

B. Certain zone types require that the BACS perform the lighting controls. The following chart outlines the BACS / Division 26 Responsibilities with regard to the BACS provided lighting controls:

BACS LIGHTING CONTROLS RESPONSIBILITY MATRIX

LIGHTING CONTROL DEVICE	BACS	DIV 26
Emergency Switched 277/120 VAC Power		X
120 VAC Power		X
Emergency Lighting Control Unit		X
Emergency Lighting Transfer Switch		X
Emergency Light Fixture		X
Emergency Lighting Dimming Override		X
Normal Power Light Fixture		X
Controller	X	
24 VAC Power	X	
Transformer	X	
Primary Power Pack Relay	X	
LIGHT ENABLE COMMAND	X	
LIGHT STATUS	X	
Secondary Power Pack Relay	X	
HVAC OCC/UNOCC COMMAND	X	
Dimming Wall Switches		X
Dimming Control Relay	X	
DIMMING COMMAND	X	
DIMMING ENABLE COMMAND	X	
Occupancy Sensors	X	
OCCUPANCY	X	
Daylight Sensors	X	
LIGHT LEVEL	X	

END OF SECTION

SECTION 230931 - CONTROL SYSTEM - LABORATORY AIRFLOW

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

B. Provide a complete Laboratory Airflow Control System, including control components required to perform the functions, intent and performance described later in this Section.

C. Provide wiring, conduit, required to connect devices furnished as part of our adjunctive to this Laboratory Airflow control system regardless of the source of supply. Control circuits, 120 volt maximum. Install wiring in accordance with requirements of "Electric Wiring in HVAC Work" Section, Electric Contract Specifications and National Electrical Code.

D. Provide all necessary devices for a fume hood control systems including make-up/supply air controllers; supply exhaust, constant volume and general purpose airflow control valves, plus all interconnecting wiring and pneumatic tubing to result in a completely operational system.

E. Furnish fume hood controllers, sash sensors and display monitors as required.

F. All control components shall be strictly electronic in nature.

G. All laboratory airflow control system components shall be the products of a single manufacturer for single point responsibility.

H. All devices specified in this section shall be provided by the BACS vendor.

1.2 ACCEPTABLE MANUFACTURERS

A. The complete system is designed and based on that manufactured by Accutrol, LLC or compatible product as manufactured by:

1. Phoenix Controls

2. Critical Room Control

1.3 SUBMITTALS

A. Submit for review, a brochure containing the following:

1. Detailed piping for wiring control diagrams and systems descriptions for each system.

2. Detailed layout and nameplate list for local control panels and DDC panels.

3. Valve schedule showing size, pressure drop configuration, capacity, and locations. Apparatus Bulletins and data sheets for laboratory airflow control system components.

1.4 GUARANTEES

A. Guarantee the new laboratory airflow control system free from defects in material and workmanship, except for damages from other causes, for a period of one year after final acceptance or Owner occupancy, whichever is earlier.

B. Guarantee System to:

1. Maintain temperature within 1°F above and below setting.

2. Maintain room pressurization control within 10% differential setpoint.

C. Provide one year maintenance service of system components, to start concurrently with the guarantee specified above. Such service shall include 24 hour emergency and seasonal (twice per year minimum) inspection and adjustment of operating controls and replacement of parts or instruments found deficient or defective during this period.

1.5 INSTRUCTION AND ADJUSTMENT

A. When the work has been completed, completely adjust the laboratory airflow control system

B. Tag equipment with designation from the submitted diagram.

1. Provide factory trained technicians to instruct the Owner's operating personnel and turn over three copies of maintenance manuals; total of three working days.

2. Submit in triplicate, letter of acknowledgment of such instructions.

1.6 WARRANTY

A. Except as otherwise specified, the Contractor shall warrant and guarantee all work against defects in materials, equipment, and workmanship for a period of one (1) year from the date of acceptance of the work as evidenced by a resolution to that effect by the Owner and for that period of time noted in special or extended warranties.

PART 2 - PRODUCTS

2.1 GENERAL

A. Airflow control valves shall be of a low pressure drop design for energy efficiency. Valves shall not require greater pressure drop than listed at Max CFM (Max L/s or CMH) on project valve schedule or 0.3” wc (75Pa), whichever is less. The provision of a larger airflow control valve that is scheduled to accommodate the lower scheduled pressure drop will not be acceptable. Airflow control valves that require higher pressures to operate will not be acceptable.

B. Demand Based Static Pressure Reset Control (DBSPRC) – Valve must be capable of being utilized with a demand based static pressure reset control scheme as described in ASHRAE Standard 90.1-6.5.3.2.3.

C. Should a venturi valve be offered as a substitute for a low pressure drop closed loop control valve the contractor offering the valve must provide each venturi valve with a static pressure reset kit which requires duct straight runs of 3x Duct Diameter (upstream of venturi valve) and 3.5x Duct Diameter (downstream of venturi valve) ensuring that the pressure pickups are located such that they will not be susceptible to clogging or condensation within the tubes. The contractor substituting the venturi valve shall also be responsible for associated design change and field duct changes to accompany the requirement of straight duct run upstream and downstream of the venturi valve (see above).

D. Each airflow control device shall be specified with the option for shut-off.

E. Fail positions shall be as follows:

1. Fume Hood Exhaust: Normally Open
2. Supply Air: Normally Open.
3. General Exhaust: Normally Closed.

2.2 CONTROLLERS (TYPICAL FOR ALL VALVES)

A. All valve controllers shall be capable of providing the full airflow range of the valve specified and not limited to the airflow range scheduled. Do not provide mechanical stops on the valve.

2.3 FUME HOOD CONTROLLER

A. A linear fume hood control system shall be provided to directly measure the area of the fume hood sash opening. The measured sash area shall proportionally control the hood's exhaust airflow to maintain the face velocity constant to a ± 10% tolerance over no less than a 5 to 1 change in the sash open area (change in sash position).

B. A vertical sash sensor shall be provided to measure the height of each vertically moving fume hood sash. The vertical sash sensor shall consist of a precision 10 turn potentiometer mechanically coupled to a constant tension spring reel. A stainless steel, vinyl coated cable shall be attached to the spring reel. Expected lifetime base on manufacturer's component data and tests shall be over 200,000 full height sash movements.

C. A horizontal sash sensor shall be provided for each pair of horizontal or overlapping sashes that are located on horizontal, combination or walk-in sash fume hoods. The horizontal sash sensor shall consist of two long, flat bars for each pair of overlapping sashes. The first bar shall contain a element to send magnetic flux to the second bar. The second bar shall contain a multitude of magnetic sensors spaced over .75 in. or less. The bars shall be mounted at the top of each sash, one per sash. As the two sashes slide past each other, the bars shall overlap to determine the total amount of sash opening.

D. A fume hood monitor shall be provided to receive the sash opening signals from the vertical and or horizontal sash sensors. The monitor shall compute the total open sash and then output an exhaust airflow control signal to the appropriate volume control device.

E. The face velocity and minimum exhaust flow level of the fume hood shall be set at the fume hood monitor via trimpot adjustments. Accurate adjustment of the face velocity shall be provided at two different sash positions.

F. An emergency exhaust capability shall be provided to override the sash sensor and command maximum exhaust air flow. A push to start, push to stop, push button switch shall initiate this mode.

G. A "night energy waste alert" circuit employing a light level sensor shall be included in the monitor to sense the combination of a darkened lab room and a fume hood that has its sash left up.

H. Fume hood monitor shall include an energy use meter to indicate a relative measure of hood air flow, visual indication for normal operation, visual and audible alarm for an unsafe flow condition, visual and audible alarm for night energy waste alert and visual and audible alarm to indicate emergency exhaust operation.

I. A push button switch shall be provided to mute the audible alarm. The mute mode is automatically reset when the alarm condition ceases.

2.4 EXHAUST, MAKE-UP AIR AND MULTI-POSITION CONTROL VALVES

A. Supply Air Valves

1. Consists of airflow control valve with vortex airflow sensor and high speed electric actuator (standard speed actuator for non-lab spaces).

2. Output to modulating actuators shall be analog.

3. The valves shall be calibrated / characterized for full manufacturer range. Actual airflows shall be set by software; allowing easy field modifications.

4. Insulated body.

5. Provide drawband clamp connections on all single valve arrangements.

B. General Exhaust Air Valves

1. Consists of airflow control valve with vortex airflow sensor and high speed electric actuator (standard speed actuator for non-lab spaces).

2. Output to modulating actuators shall be analog.

3. The valves shall be calibrated / characterized for full manufacturer range. Actual airflows shall be set by software; allowing easy field modifications.

4. Provide drawband clamp connections on all single valve arrangements.

C. Fume Hood Exhaust Air Valves (VAV)

1. Consists of airflow control valve with integrated high performance vortex airflow sensor and high speed electric actuator.

2. Valve materials shall be suitable for the conveyed atmosphere; either having a 304 stainless steel body or an interior corrosion resistant coating.

3. Actuators shall move full stroke in less than one second.

4. Output to modulating actuators shall be analog.

5. The valves shall be calibrated / characterized for full manufacturer range. Actual airflows shall be set by software; allowing easy field modifications.

6. Provide drawband clamp connections on all single valve arrangements with PTFE adhesive tape to protect the drawband clamp gasket.

D. Fume Hood Exhaust Air Valves (CV / Multi-position CV)

1. Consists of airflow control valve with vortex airflow sensor and high speed electric actuator.

2. Valve materials shall be suitable for the conveyed atmosphere; either having a 304 stainless steel body or an interior corrosion resistant coating.

3. Actuators shall move full stroke in less than one second.

4. Output to modulating actuators shall be analog.

5. The valves shall be calibrated / characterized for full manufacturer range. Actual airflows shall be set by software; allowing easy field modifications.

6. Provide drawband clamp connections on all single valve arrangements with PTFE adhesive tape to protect the drawband clamp gasket.

E. Specialty Exhaust Air Valves (CV / Multi-position CV)

1. Consists of airflow control valve with vortex airflow sensor and high speed electric actuator.

2. Valve materials shall be suitable for the conveyed atmosphere; either having a 304 stainless steel body or an interior corrosion resistant coating.

3. Actuators shall move full stroke in less than one second.

4. Output to modulating actuators shall be analog.

5. The valves shall be calibrated / characterized for full manufacturer range. Actual airflows shall be set by software; allowing easy field modifications.

6. Provide drawband clamp connections on all single valve arrangements with PTFE adhesive tape to protect the drawband clamp gasket.

F. The Airflow Control Valve shall consist of a compression section, two airflow control surfaces, factory-mounted digital vortex airflow measuring device factory-mounted high speed electric actuator, integral access panel and integrated high performance closed-loop feedback controller with native BACnet.

G. The compression section shall divide the airstream into at least two separate airstreams. Each airstream shall be approximately equal in size and the total open area shall be approximately 50% of the duct open area. The divided sections shall cause compression therefore creating a more laminar flow for better airflow measurement and turndown. The compression section shall be of an aerodynamic shape with a static regain section to insure minimal pressure drop. The valve shall not require any duct straight runs either upstream or downstream of the airflow valve to achieve required specified performance.

H. Airflow control valves shall be a linear type and shall operate with a minimum turndown ratio of 8 to 1. Accuracy of the airflow valve shall be 5% of reading in the 8 to 1 range of the damper.

I. The airflow control valve speed of response shall be <1 second (<2 seconds for standard speed actuation).

J. The airflow control valve shall be capable of being mounted in any position (360º mounting plane) in ductwork without the need for recalibration. It shall not be required to specify mounting plane when ordering valve.

K. Valve body material for Fume Hood or other corrosive service shall be 304SS; 20gauge for body and 16gauge for blades. Valve shaft material shall be 316SS.

L. Valve body material for non-lab (non-corrosive) service such as for Supply and Return or Exhaust shall be 18 gauge aluminum for body and 16 gauge for blades. Valve shaft material shall be 416SS. Valve body material for lab spaces (non-corrosive) service such as for Supply and Return or Exhaust shall be 16 gauge (aluminum) for body and 16 gauge for blades. Valve shaft material shall be 316SS.

M. Airflow control valves shall operate without linkages, springs, levers, or bearings, in the airstream due to the effect of exhaust air on those materials, and shall exhibit no deadband or hysteresis.

N. All critical components of the airflow control valve shall be easily accessible from one side of the valve. All linkages shall be out of the airstream to avoid possible corrosion and loss of accuracy.

O. The airflow valve shall be complete with a digital vortex type airflow sensing device providing true airflow feedback for the system.

P. Airflow measuring devices shall be of the Vortex Shedding type, capable of continuously monitoring the airflow volume of the duct served and electronically transmitting a signal linear to the airflow volume.

Q. Individual airflow sensors shall be of rugged construction, and shall not require special handling during installation. Sensors shall be mounted on support bars. Standard materials shall be manufactured of corrosion resistant plastic.

R. Individual velocity sensors shall not be affected by dust, temperature, pressure, or humidity. The sensors shall be passive in nature, with no active parts within the air stream. The output from individual sensors shall be linear with respect to airflow velocity and shall be capable of sensing airflow in one direction only. The velocity sensors shall not require calibration.

S. Airflow control valves shall have factory installed high speed electric actuator (standard speed actuator for non-lab spaces) specifically adapted to the stroke of the valve which shall operate on 24VAC. Power requirement for each airflow valve actuator shall not exceed 24VA.

T. Airflow control valves shall have an integral closed-loop feedback controller. Airflow measurement through the vortex airflow sensor shall send the digital signal to the controller which modulates the electric actuator to maintain desired airflow setpoint. The airflow setpoint shall have the capability of being provided through analog input, digital input, communications over BACnet MS/TP or AVC internal program memory. Analog output signal shall be provided for airflow and alarm outputs must be provided to indicate abnormal airflow conditions.

1. Airflow Control Valve integral controller shall provide an EIA-485 port supporting BACnet MS/TP as a Full Master Node state machine. Field programming shall be accomplished through an intuitive PC based UI (User Interface) tool. Connection between the integral controller and the computer shall be provided through a USB port located on the AVC control module.

2. Power requirement for each airflow valve with integral controller shall not exceed 28VA for all round, 12"x18" and 12"x24" valves and 55VA for 12"x36" and 12"x48" valves.

2.5 EXHAUST, MAKE-UP AIR AND TWO-POSITION CONTROL VALVES (VENTURI STYLE)

A. Airflow control valve shall be of venturi control type utilizing a venturi section into which a cone shaped element slides to create a smoothly varying, ring shaped orifice. Valve shall have an equal percentage flow characteristic to provide stable control at low flow values.

B. Valve shall be pressure independent and use closed loop control to regulate air volume linearly proportional to a 0 to 10 volt electronic control signal. Valve shall also generate a 0 to 10 volt feedback signal linearly proportional to valve airflow for internal volume control, monitoring, or airflow tracking control. Signal shall be factory calibrated to a stated CFM per volt scale factor using NBS traceable instrumentation. Accuracy shall be ± 5% of reading regardless of inlet or exit duct configuration over a range of no less than 8 to 1.

C. An electric actuator shall be factory mounted to the valve body to vary the position of the valve cone from its minimum to maximum flows. Loss of power shall cause exhaust valves to fail open and supply valves to fail closed.

D. Any electronic (hot wire, thermistor, etc.) airflow sensor exposed to exhaust airflow shall be UL listed under the UL913 class 1, division 1 standard for intrinsically safe equipment used in hazardous locations.

E. Valve shall be constructed of one of the following types. Refer to the valve schedule for the specific type:

1. Type #1 (Supply/General Exhaust): Valve shall be constructed of heavy gauge aluminum or galvanized steel. All critical bearing surfaces related to the control of airflow shall be made of Teflon or Teflon infused aluminum. Supply Valve shall have an insulated body.

2. Type #2 (Fume Hood Exhaust): Valve body and cone shall be of corrosive resistant design using baked-on phenolic coating material. The valve's shaft and other exposed metal parts shall be PFA coated 316 stainless steel.

F. A reduction of airflow of approximately 25% below the setpoint shall be sensed and alarmed by a static pressure switch premounted to a hood exhaust valve. The switch shall operate by measuring the pressure drop across the valve's variable orifice venturi.

G. Provide flanged duct connection on all multiple valve arrangements.

H. Provide drawband clamp connections on all single valve arrangements. For fume hood exhaust valves, provide PTFE adhesive tape to protect the drawband clamp gasket.

I. Provide fan static reset kit. Pressure pickups shall be located per manufacturer's installation instruction. There shall be no obstructions for a minimum of 3 equivalent duct diameters upstream, and 3.5 equivalent duct diameters downstream of the valve.

2.6 MAKE-UP AIR CONTROL UNIT

A. A Make-up Air Control Unit shall be supplied to control the airflow balance of the laboratory room. The Make-up air control unit shall be panel or valve mounted.

B. Integral field adjustable trim points shall be provided for all required calibration and scaling adjustments.

C. The control unit shall maintain a constant adjustment offset between the sum of the room's total exhaust and the make-up/supply air volumes. This offset shall be independent of the exhaust volume magnitude and represent the volume of air that will enter the room from the corridor or other room.

D. The control unit shall generate 0 to 10 volt analog signals linearly proportional to the airflow to each exhaust air source as indicated by the calibrated input signals. Similar output signals shall also be provided for the supply, general exhaust (if appropriate), and total exhaust airflow volume signals. These signals shall be provided for calibration, local monitoring, and direct connection to the central DDC system.

E. An integral power supply for the panel mounted unit, or a valve mounted power supply for the valve mount unit, shall be included to power the complete laboratory air flow control system from on 120 VAC line connection.

F. A liquid crystal digital display reading out directly in CFM shall be provided for panel mounted control units to indicate the magnitude of all exhaust and supply airflow signals specified above.

G. Provide factory sound neutralizer for all general exhaust valves. Install per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials shall be furnished and installed by the Automatic Temperature Controls (ATC) Trade as recommended by the Laboratory Airflow Controls Manufacturer.

B. The ATC Trade shall install the sash sensor and the monitor on the fume hood. Vertical sash sensor and its stainless steel cable shall be hidden from view. Horizontal sash sensor bars shall be affixed to the top of the individual sash panels.

C. Linearized airflow control valves shall be installed in ductwork by the Mechanical Trade. Valves shall be mounted in the position specified to insure calibrated performance.

D. The ATC Trade shall install the Make-up/Air Supply Control in an accessible location within the indicated laboratory room. Single phase 110 VAC power shall be wired to the Control Panels and the valve mounted power supplies be the Electronic Trade.

E. The ATC Trade shall extend eight wire cables from the fume hood monitors to the fume hood exhaust valves; from the fume exhaust valves, two position exhaust valves and lab office supply valves to the make-up/supply air control units; and from the make-up/supply control units to the make-up/supply air control valves and general exhaust/return valves. Two wire cables attached to the sash sensors shall be routed into their associated fume hood monitor. The ATC Tradeshall terminate and connect cables as required.

3.2 START-UP AND CALIBRATION

A. System start-up, calibration shall be provided by a factory authorized representative of the Laboratory Airflow Controls Manufacturer. Start-up shall include setting of the fume hood face velocity, supply/make-up and/or general exhaust flow and complete air balance with report as outlined in Section 15990.

PART 4 - SEQUENCE OF OPERATION

4.1 LABORATORY AIRFLOW CONTROL

A. Refer to drawings for sequence of operation.

B. The control unit shall increase the flow at the general exhaust valve under conditions where additional exhaust is required to maintain the room's airflow balance to maintain temperature setpoint. The general exhaust valve command shall equal the algebraic difference between the supply volume and the hood's make-up air volume.

C. If any lab office supply valves are used (for offices that are part of the lab area), then the supply volume of these valves must be subtracted from the make-up air command for the lab make-up/supply valve.

END OF SECTION

SECTION 232010 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Schedule of pipe materials, fittings, and connections.

B. Applicable miscellaneous materials (i.e. dielectric protection, hangers, inserts, supports, sealing elements, firestop systems etc.).

C. Anchors and Guides:

1. Provide detailed fabrication drawings for all field-fabricated anchors and guides and intermediate structural elements.

2. Provide submittals for pre-manufactured anchors and guides.

D. Welding certification (Refer to Part 3).

E. Water Treatment Product Data (Refer to Part 3).

F. Cleaning of various hydronic piping systems (Refer to Part 3)

1. Submit typewritten letter to inform Owner's Representative upon completion of the work.

G. Water Testing (Refer to Part 3)

1. Certification of successful pressure testing (Refer to Part 3)

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All adhesives, sealants, primers and paint used for piping in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, Schedule 40, or extra strong (Schedule 80) weight; black or galvanized finish as called for; ends chamfered for welding.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type, chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets", or "Sockolets" are acceptable. Socket weld type, 2000 psi wp, where required.

a. Mitered elbows, "shaped" nipples, and fabricated reductions and fabricated branch connections are not acceptable unless specifically required and reviewed by the Engineer.

2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron, 150 or 300 lb. wwp, based on system pressure. Steel thread protectors are not acceptable as couplings.

2. Welded connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents and working temperatures and pressures.

c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent. Made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
2 in. to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 COPPER TUBE AND FITTINGS - SOLDER JOINT

A. Pipe: ASTM B88; Type L hard temper. Plans show copper tube sizes.

B. Tees, Elbows, Reducers: Wrought copper, ASME B16.22; ASME B16.18 solder end connections.

C. Unions And Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel.

E. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Willard Industries "Solder Safe (silver bearing), Canfield "Watersafe" or approved equal.

2.4 COPPER DRAINAGE TUBE AND FITTINGS - SOLDER JOINT

A. Pipe: ASTM B88; Type M hard temper.

B. Tees, Elbows, Reducers: Wrought copper, ASME B16.22; ASME B16.18 solder end connections.

C. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.

D. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Canfield "Watersafe", or approved equal.

2.5 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Dielectric unions shall not be used due to their tendency to leak. Provide a dielectric waterway fitting or a brass nipple for dielectric protection. A brass valve is also an acceptable method of dielectric protection.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Waterway Fittings: 300 psi maximum working pressure at 230°F, male threaded or grooved ends, electroplated ductile iron or steel body with LTHS high temperature polyolefin polymer liner.

E. Make: EPCO, Capitol Manufacturing, Watts or approved equal.

F. The use of brass valves and brass nipples (3 in. and larger) may be used for dielectric isolation.

2.6 HANGERS, INSERTS, AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing, Anvil, Hilti.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Adjustable steel clevis type for 4 in, and larger, and where insulation passes through hanger.

4. Hangers sized to permit passage of insulation through the hanger for all piping.

C. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped Hanger Shields:

1. Pre-Insulated Type:

a. Insulated pipes shall be protected at point of support by a 360° insert of high density, 100 psi waterproof calcium silicate, encased in a 180° sheet metal shield. Insulation insert to be same thickness as adjoining pipe insulation and extend 1 in. beyond sheet metal shield. Insulation shall be provided with a factory installed ASJ.

2. Field-Insulated Type:

a. #18 USSG, galvanized steel shields, minimum 120° arc. Provide ICA-HAMFAB-BLOCK, 18# density molded fiberglass inserts, between pipe and hanger shield to maintain proper spacing for insulation. Insulation inserts shall extend 1 in. beyond the sheet metal shields.

Material shall comply with ASTM E84 25/50, have a thermal conductivity of K=.30 (stable) and have a service temperature of -120°F to +650°F. Install in accordance with manufacturer's printed instructions.

3. Shield Sizing:

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2 in. to 3-1/2 in.	9 in.	20
4 in.	9 in.	20
5 in. and 6 in.	9 in.	20
8 in. to 12 in.	12 in.	18
14 in. to 24 in.	18 in.	16

4. Hanger shield gauges listed are for use with band type hangers only. For point loading (roller support), increase shield thickness by one gauge, and length by 50%.

D. Hanger Spacing Schedules: (Based upon most stringent requirement of MCNYS and ASME B31.9)

COPPER OR PLASTIC PIPE SIZE	COPPER PIPE HANGER SPACING	PLASTIC PIPE HANGER SPACING	HANGER ROD SIZE
3/4 to 1 in.	6 ft.	3 ft.	3/8 in.
1-1/4 in.	6 ft.	4 ft.	3/8 in.
1-1/2 to 2 in.	8 ft.	4 ft.	3/8 in.
2-1/2 to 4 in.	10 ft.	4 ft.	1/2 in.
5 in. and larger	10 ft.	4 ft.	3/4 in.

STEEL PIPE SIZE	STEEL PIPE HANGER SPACING	HANGER ROD SIZE
3/4 to 1 in.	8 ft.	3/8 in.
1-1/4 in.	10 ft.	3/8 in.
1-1/2 to 2-1/2 in.	12 ft.	3/8 in.
3 to 4 in.	12 ft.	1/2 in.
5 in. and larger	12 ft.	3/4 in.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1,300 lbs., for 3/8 in. to 3/4 in. rod sizes. Drill through decking for hanger rods and secure devices with integral support plate strap with sheet metal screws. Devices shall have a safety factor of four.

F. Beam Attachments:

1. C-Clamp, locknut, electroplated finish, UL listed, FM approved, for pipe sizes 2 in. and smaller.

2. Center load style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

3. Welded beam attachments may be considered only upon the review and acceptance of the structural engineer of record with written confirmation of weld meet configuration, location and service/pipe size submitted to the Mechanical Engineer for review.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For Weights Under 1000 lbs.: Insert, "U" shaped channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flush plate welded to top of rod or provide additional inserts and hangers to reduce load per hanger below 1000 lbs.

4. Make: Hilti, ITW Ramset, Phillips "Red Head", or approved equal.

H. Trapeze Hangers:

1. For use on 1-1/2" and smaller piping only. Use of trapeze hangers for piping 2” and greater may be considered only upon the review and acceptance of the structural engineer of record with written confirmation of configuration, location and service/pipe size submitted to the Mechanical and Structural Engineer for review.

2. Hangers shall be supported with rod sized with a safety factor of four.

3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.

4. Securely fasten piping to trapeze with "U" bolt or straps, dissimilar metals shall not touch, use isolation gaskets.

5. Make: B-Line, Kindorf, Unistrut, or approved equal.

2.7 PIPING ACCESSORIES

A. Escutcheon Plates: Provide escutcheon plates on uninsulated piping in exposed and finished areas. Steel or cast brass polished chrome, split hinge type with setscrew, high plates where required for extended sleeves.

B. Pipe Guides: Cylindrical steel guide sleeve, proper length for travel, integral bottom base anchor, top half removable. Split steel spider to bolt to pipe, copper plated spider for copper pipe. Insulated style where pipe is required to be insulated. Make: Tri-State Industries, or equal.

C. Anchors:

1. Pipe support; same material as pipe; as manufactured by Pipe Shields Model C1000 or C2000, Keflex, Metraflex, Flexonics or Advanced Thermal Systems.

2. Pipe Anchors:

a. Anchors shall be designed and located as to prevent stress to piping or building structural components from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stressing to connected equipment.

D. Pipe Roll Stand: Cast iron roll stand. Make: Advanced Thermal Systems, Carpenter and Patterson, ITT Grinnell, Pipe Shields.

2.8 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves shall be used for sleeves in horizontal and vertical applications through structural surfaces. Sleeves shall extend a minimum of 1 in. beyond both sides of the structure surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping installation or requirements of the sealing element manufacturer.

2. Full circle water stop collar for sleeves located in below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

3. Schedule 40, PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing. Sleeves shall extend a minimum of 1/2 in. beyond both sides of the non-structural vertical surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping.

B. Pre-Insulated Type:

1. Adjustable or fixed length metal cans, 24 gauge minimum sized for 1 in. spacing between insulation and can. Insulation shall consist of a 360° waterproofed calcium silicate insert sized to extend 1 in. beyond wall or floor penetration. Calcium silicate insert shall be the same thickness as adjoining pipe insulation. Spacing between shield and can packed at each end with double neoprene rope positively fastened.

2.9 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Penetration Firestop Systems". The system shall meet the standard fire test for Penetration Firestop Systems designated ASTM E814. Firestop system shall be provided at locations where piping passes through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.10 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (HVAC) piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Provide equipment and systems in accordance with laws, codes, and provisions of each applicable section of these specifications. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing (except where specifically called for), making proper allowance for expansion and anchoring. Arrange piping at equipment with necessary offsets, union, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Install drains consisting of a tee fitting with a 3/4 in. ball valve with hose end cap and chain, at low points in hydronic piping system mains, and elsewhere as required for system drainage.

B. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings unless submitted and accepted per Part 2. Do not install valves, union and flanges in inaccessible locations. Provide trap seal of adequate depth on drain pans.

C. Provide reducers at all control valves, where control valve is smaller than pipeline size. Reducers for steam control valves shall be eccentric type. Provide unions at each side of every control valve and reducers directly adjacent to the unions.

D. Provide reducers at all balance valves, where balance valve is smaller than pipeline size.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3 ft. to 9 ft. depending on the voltage.

3.3 WATER AND GLYCOL SYSTEMS

A. Top connection for upfeed, bottom or side connection for downfeed. Grade off level; up in direction of flow and down toward drain.

3.4 CONDENSATE DRAIN PIPING

A. Condensate drain piping shall be sloped a minimum of 1% in the direction of flow to an approved place of disposal. Condensate shall not be disposed into a street, alley or other areas so as to cause a nuisance.

B. Condensate drain piping shall not be less than 3/4" internal diameter and shall not decrease in size from the drain pan connection to the location of condensate disposal.

C. Condensate drains shall be trapped as required by the equipment or appliance manufacturer.

D. Condensate drain piping shall be configured to permit the clearance of blockages and performance of maintenance without requiring the drain piping to be cut.

3.5 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, or from other piping. Support each pipe with individual hangers from concrete inserts, welded supports, or beam clamps of proper configuration and point loading design requirements for each location including the designated safety factor. Trapeze hangers are acceptable for racking of multiple pipes of 1-1/2 in. or less in size. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size as called for, using four nuts per rod. Provide additional rustproofed structural steel members, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Only concentric type hangers are permissible on piping larger than 2-1/2 in., "C" types are permitted for piping 2-1/2 in. and smaller. Provide riser clamps for each riser at each floor.

B. Provide a pipe hanger within 12 in. of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.6 HANGERS ATTACHED TO JOISTS

A. Individual hangers may be suspended directly from the bottom chord panel point provided that the sum of the concentrated loads within the chord panel does not exceed 100 pounds and the attachments are concentric to the chord. (Eccentrically loaded joists using beam clamps or other attachment methods are not acceptable.)

B. For nominal concentrated loads between panel chords, which have been accounted for in the specified uniform design load for the joists, this Contractor is to provide struts to transfer the load to a panel point on the opposite chord as reviewed and acceptable by the Structural Engineer of Record.

3.7 PIPE CONNECTIONS

A. Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specific for each application.

C. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

D. Dielectric Pipe Fittings: Provide dielectric protection devices at ALL piping connections and ALL equipment connections, where dissimilar metals meet. Follow all applicable manufacturer's recommendations at equipment connections. Dielectric protection systems are not required for air or gas systems.

3.8 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. When welding galvanized pipe, apply cold galvanizing on joint after welding.

3.9 HANGER SHIELDS

A. Provide at hangers for all piping. Pre-insulated type or field-insulated type at Contractor's option.

3.10 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors which are core-drilled, except where floor is waterproofed.

B. Pre-Insulated Type: Required for chilled water.

C. Standard type: Provide for piping, except as called for.

D. Extend 1/8 in. above finished areas. In above grade mechanical and other areas with floor drains; use steel pipe sleeves 2 in. above floor. Use pipe sleeves in bearing walls, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.11 ANCHORS

A. Provide piping system anchors where shown on the plans, and as recommended by the expansion joint/loop manufacturer. Where an anchor is shown at a change in piping direction, it shall fully control movement in both directions. In lieu of a single anchor fabricated for two directional control, two (2) individual anchors may be provided. Provide detailed fabrication drawings for all field-fabricated anchors.

B. Design anchors and equipment and piping supports including comprehensive structural engineering analysis by a qualified professional engineer, licensed to practice in the State of New York using the performance and design criteria specific to this project.

3.12 ALIGNMENT GUIDES

A. Provide alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two (2) or more guide(s) on each side of flexible expansion loop. Install guides nearest to expansion joint not more than four (4) pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

3.13 SLEEVE PACKING

A. Seal void space at sleeves as follows

1. Interior locations: Firmly pack with fiberglass and caulk.

2. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

3. Waterproofed walls and floors: Use waterproof sealing element, device, or compound.

3.14 ESCUTCHEON PLATES

A. Provide polished chrome escutcheon plates for uninsulated exposed piping passing through floors, walls or ceilings in finished areas.

3.15 CLEANING HOT WATER AND CHILLED WATER AND GLYCOL SYSTEMS

A. Provide the services of an experienced Water Treatment Subcontractor.

B. After each closed system has been tested and thoroughly flushed, the entire piping system shall be cleaned by, or as per, the Water Treatment Subcontractor.

C. Pumps shall not be operated continuously until system is flushed, strainers cleaned and water treatment is complete.

D. Cornell University's continual approach of protecting its community and the environment must be adhered to in the application of chemicals pertinent to process water loops. In addition, University policy dictates that "under no circumstances should chemicals be disposed of by pouring into sinks or other drains leading to sanitary or storm sewers".

E. All chemicals and formulations prescribed for the cleaning and treatment of process water systems at the University must meet the following specified criteria:

1. They must be ecologically compatible so that any discharge will not create an environmental impact. All chemicals and formulations must comply with NY State SPDES (State Pollution Discharge Elimination System) regulations and be free of compounds listed by the EPA on the Priority Pollutant List as defined by 40 CFR Part 423 Appendix A.

2. They must be industrial and toxicologically safe so as to minimize personnel and equipment exposure to hazardous conditions.

3. Every effort must be made to maintain a sense of uniformity in chemical formulation to insure a line of continuity. Deviation from existing formulations that are applied across the University are not allowed. This relieves the University of any burden that arises from trying to maintain adequate protection using numerous treatments.

4. Ethylene Glycol (CAS 107-21-1): This material is considered hazardous substance per the 6 NYCRR Part 598. Any release (defined as unauthorized pumping, pouring, emitting, emptying, overfilling, spilling, leaking, leaching, or disposing, directly or indirectly into the environment0 in the amount of 1 pound of ethylene glycol into the air, land or water must be reported to the New York State Department of Environmental Conservation. For this reason, Cornell prohibits the use of ethylene glycol.

F. All water treatment proposed for application at Cornell University must have the prior approval of Cornell University Environmental Health and Safety, Facilities Engineering and the Facilities Management Water Treatment Lab prior to purchase, delivery or application. In order to thoroughly evaluate the products performance, it is recommended that the following be submitted at the time of proposal:

1. Safety Data Sheets (SDS) for all products that are to be applied, which shall contain the complete formulation. Further documentation of qualitative composition must be included if SDS's do not supply all product(s) components.

2. Product Data Sheets specifying overall product description and application guidelines.

3. Methods of analysis for determining product residuals. Proposals should specify qualitative and quantitative procedures of evaluating actual product levels. They should also include recommended parameters for all products, expressed in either terms of parts per million or milligrams per liter.

4. Expected performance levels of products; this should include expected corrosion rates, expressed in mils per yea. If the product is a biostatic nature, what levels of biological growth should be expected if the product is applied at recommended dosages.

5. Provisions should be submitted for the removal for any unused chemicals. In addition, provisions must be provided for the disposal of all empty containers.

G. Cleaning:

1. Cleaning procedures for newly installed systems shall be as follows:

   a. Step 1: Adjust all control valves and balancing valves to full open position during the cleaning and treatment process.

   b. Step 2: Fill system and add a general dispersant for iron, mud, silt, and microbiological matter at a concentration recommended by the chemical manufacturer. Pay particular attention to the type of material being cleaned (steel, copper, aluminum, etc.) Test for concentration. Circulate solution for a minimum of eight hours. Flush system until system water pH and iron levels are consistent with the feed domestic water levels. Clean strainers and dead end piping legs. Provide test results to the Facilities Management Water Treatment Lab;

   c. Step 3: Arrange for inspection by a representative from the Facilities Management Water Treatment Lab before proceeding to chemical treatment.

2. For extensions to existing building systems, follow the procedures for newly installed systems. Provide temporary piping, valving, and pumping system isolated from the existing building system as needed to perform cleaning procedures prior to final connection to the existing building system.

H. Water Treatment:

1. After system cleaning, furnish report of water test to determine quality.

2. Water treatments shall be deemed complete when acceptance received by Cornell University the Facilities Management Water Treatment Lab.

3. Existing Systems – Field verify existing treatment chemical quantities to ensure correct quantities are added back to the system following construction.

4. Treatment Chemicals for hydronic heating and chilled water cooling systems, not connected to the campus chilled water loop, shall be as follows:

   a. Non-Glycol Systems (non-potable): After cleaning and inspection, immediately add a molybdate based corrosion inhibitor. Acceptable corrosion inhibitors shall include a combination of sodium molybdate, sodium hydroxide, tolytriazole and organic polymers. Test for residual concentrations as follows:

      1) Molybdate (M06): 150 ppm (hot water systems)
      2) pH: 8.3-9
      3) Tolytriazole (TTA): 10-20 ppm

   b. Glycol Heating Systems: After cleaning and inspection, drain system then refill with glycol as specified in Water System Specialties.

   c. The water to be added to glycol systems shall meet the manufacturer's standards for quality.

   d. Arrange for inspection by a representative from the Facilities Management Water Treatment Lab prior to final acceptance.

5. Chilled water systems connected to campus chilled water loop shall be cleaned, inspected, and filled with potable water. Notify the Cornell University Central Energy Plant (CEP) for permission to begin circulating water to the campus chilled water loop.

I. Identification

1. Provide a three ring binder for each hydronic system treated with chemicals that includes the following information:

   a. SDS
   b. Product data sheets
   c. Chemical type
   d. Test points
   e. Control limits
   f. System volume
   g. Direction to drain system to sanitary.

h. System volume shall be stenciled on the system expansion tank and glycol tank in a visible location.

3.16 TESTS

A. Test piping and accessories before insulation, connection to existing piping, or concealment. Repeat as many times as necessary to prove tight system. Notify Owner's Representative at least seven days in advance of each test. Isolate valves and equipment not capable of withstanding test pressures. Make leaks tight; no caulking permitted. Remove and replace defective fittings, pipe or connections. Furnish necessary pumps, gauges, equipment, piping, valving, power and labor for testing. Certify that tests have been successfully completed.

B. Test: No change in pressure under stable temperature conditions.

C. Schedule of Test Requirements:

1. Hot, Glycol, Chilled: Hydrostatic, 100 psig at high point of system; two hours duration.

2. Equipment: Test at working pressures.

3.17 PROTECTION AGAINST PHYSICAL DAMAGE

A. In concealed locations where piping, other than cast-iron or steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 in. from the nearest edge of the member, the pipe shall be protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575 in. (No. 16 gage) shall cover the area of the pipe where the member is notched or bored, and shall extend note less than 2 in. above sole plates and below top plates.

3.18 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe sizing changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (HVAC)

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Hot water / Glycol hot water heating 3 in. and larger	ASTM A53 Schedule 40, black steel	ASME B16.9 Wrought steel	ASME B16.9 Butt weld
Hot water / Glycol hot water heating 2-1/2 in. and smaller	ASTM B88 Type L hard copper	ASME B16.22 Wrought copper	ASTM B32 95 Sn/5 Sb solder or 95.5 Sn/4 cu/.5 Ag solder
Chilled water 3 in. and larger	ASTM A53 Schedule 40, black steel	ASME B16.9 Wrought steel	ASME B16.9 Butt weld
Chilled water 2-1/2 in. and smaller	ASTM B88 Type L hard copper	ASME B16.22 Wrought copper	ASTM B32 95 Sn/5 Sb solder or 95.5 Sn/4 cu/.5 Ag solder
Vent, overflow, condensate drain	ASTM B88 Type M hard copper	ASME B16.22 Wrought copper	ASTM B32 95 Sn/5 Sb solder or 95.5 Sn/4 cu/.5 Ag solder

END OF SECTION

SECTION 232110 - WATER SYSTEMS SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Submit product data on water system specialties.

1.3 GENERAL REQUIREMENTS

A. Equipment and accessories shall be rated for a minimum of 125 psi wwp, and 250°F temperatures.

B. All equipment shall be installed in accordance with manufacturer's written installation instructions and schematics.

C. Combination devices and pre-piped manufacturer coil fit out kits are not permitted, including but not limited to the following:

1. Manual balance, control, ball isolation valves
2. Manual balance, strainer, ball isolation valves (TDV)
3. Y-strainer, ball isolation valves
4. Ball isolation, drain valves
5. Balancing, shutoff valves

PART 2 - PRODUCTS

2.1 HIGH EFFICIENCY IN LINE AIR SEPARATOR

A. All fittings shall be fabricated steel, rated for 150 psig design pressure and be selected for less than 1 foot of water pressure drop and velocity not to exceed 4 feet per second through the unit at specified GPM. Performance curves from the unit manufacturer shall be furnished as part of the submittal for each unit. Units to include internal copper coalescing medium to facilitate maximum air elimination and suppress turbulence. Provide integral high capacity float actuated air vent at top fitting of tank. Alternates must include cast iron float actuated air vent rated at 150 psig which shall be threaded to the top of the fitting. Unit shall have bottom blow down connection with ball valve.

B. Air separators shall be capable of removing 100% of free air, 100% of entrained air and up to 99.6% of dissolved air in the system fluid. System efficiency and performance shall be third party tested and certified.

C. Design Equipment: Spirovent.

2.2 PRESSURIZED EXPANSION TANKS AND ACCESSORIES

A. Steel tanks, 125 psi wwp, ASME construction, with reinforced opening of size and location as required. Red oxide coating outside and final exterior coat of paint; factory applied. Heavy duty butyl rubber removable bladder. Full acceptance vessel. Maximum operating temperature of 240°F. Provide ring stand.

B. Design Equipment: The John Wood Company

C. Manufacturers: Armstrong, Bell & Gossett, The John Wood Company

2.3 AIR ELIMINATING SUPPLY FITTING

A. Designed to eliminate air from supply water; located in supply header from heat generating devices; flanged or screwed.

B. Design Equipment: Bell & Gossett "Airtrol".

C. Manufacturers: Armstrong, Bell & Gossett, Spirotherm.

2.4 MAKE-UP WATER VALVES

A. Bronze body, stainless steel rim, gauge tapping on outlet side. Adjustable Range: 25 to 75 psi.

B. Manufacturers: Watts No. 1156 or U5 Series.

2.5 RELIEF VALVES

A. To relieve full heating capacity.

B. Provide an ASME labeled safety relief valve as called for on the plans/details.

C. Manufacturer: ITT, Bell & Gossett, Watts, Kunkle, Spence, Keckley.

2.6 FLOW BALANCERS

A. High Performance, Bronze Body, Y-Pattern with brass readout valves with integral self-sealing EPT readout valves.

B. Valve shall be multi-turn globe style with calibrated digital hand wheel capable of at least four turns with graduations at $1/10^{th}$ turn. Hand wheel shall be equipped with a positive, tamper-resistant memory stop that effectively prevents opening valve past the stop.

C. Valve shall not be integral to flow balancer. Combination services are not acceptable.

D. Valve shall be provided with an integral, positive, tamper-resistant memory stop feature which is not subject to accidental readjustment when the valves is operated as a shut-off for service purposes. Memory stop shall require a tool for adjustment.

E. Valve shall have provisions for a seal to prevent re-setting.

F. Valve shall exhibit an accuracy of +/- 5% within its normal operation flow range.

G. Valves shall be rated for a maximum temperature of 230°F and a maximum pressure of 250 psig.

H. Valves shall be manufactured from Bronze or Dezincifcation resistant brass in sizes through 2" nominal, and bronze or cast iron in sizes above 2" nominal.

I. For chilled water applications, valve shall be provided with preformed insulation to permit access for balance and readout.

J. Mechanical Contractor shall supply Testing and Balancing Contractor with flow calculator (circular slide rule, etc.), if requested.

K. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60
2-1/2 in.	60 - 100
3 in.	100 - 180
4 in.	180 - 300
5 in.	300 - 450
6 in.	450 - 600

1. Design Equipment: Tour & Anderson.

2. Manufacturers: MMA, Macon, Tour & Anderson.

L. 5 in. and Larger: Nickel-plated flow meter with provisions for connecting a portable differential pressure meter. Shall be individually calibrated. Provide with a butterfly valve with memory stop at each location.

1. Flow meter size shall be based upon manufacturer's recommended gpm range rather than pipe size.

2. Design Equipment: Tour & Anderson.

3. Manufacturers: MMA, Macon, Tour & Anderson.

2.7 SUCTION DIFFUSER

A. Provide as shown on plans, an angle pattern flow straightening fitting equipped with a combination diffuser-strainer-orifice cylinder, flow straightening vanes, start-up strainer and adjustable support foot.

The combination diffuser-strainer-orifice cylinder shall be designed to withstand pressure differential equal to the system pump shutoff head (maximum 175 PSIG) and shall have a free area equal to five times the cross section area of the pump suction opening. The length of the flow straightening vanes shall be no less than 2-1/2 times the diameter of the system pump suction connection.

B. The Flow Straightening Fitting shall have NPT, flanged or (grooved) mechanical system connections as applicable. The fitting shall have a stainless steel combination diffuser-strainer-orifice cylinder with 3/16 in. diameter perforations to protect the system pump, and full length flow straightening vanes shall provide nonturbulent flow to the suction side of the system pump. The start-up strainer shall be of 16 mesh bronze, and the support foot shall eliminate pipe strain at the flow fitting/pump connection. All internal components shall be replaceable.

C. Construction Materials:

1.	Body and Cover:	NPT and Flanged Models Grooved Models	Cast Iron Ductile Iron
2.	Straightening Vanes:	X Models Z and Grooved Models	Steel Stainless Steel
3.	Orifice Cylinder:	Z and Grooved Models	Stainless Steel
4.	Start-Up Strainer:	X, Z and Grooved Models	16 Mesh Bronze
5.	O-Ring Seal:	All models	EPDM

6. Type X Models (for closed systems).

7. Type Z for (open systems).

D. Design Equipment: Bell & Gossett.

E. Acceptable Manufacturer: Bell & Gossett, Armstrong, Grundfos.

2.8 DUPLEX STRAINER (CHILLED WATER)

A. Construction Materials:

1. 125 psig working pressure.
2. Bronze diverter valve.
3. Flanged end connections.
4. Cast iron body and bolted cover.

5. Perforated stainless steel basket screen.
6. Viton seals.

B. Accessories:

1. Differential pressure indicators.
2. DIN Electrical probes.
3. 100% shut-off.
4. Air eliminators.

C. Acceptable Manufacturers:

1. Keckley Model DPXF or equal

2.9 STRAINERS

A. Cast semi-steel body or cast iron construction for steel piping and bronze body construction for copper piping; equipped with removable, monel or stainless steel water screen; maximum pressure drop 2 psi with free area at least four times area of pipe. Provided with blow-off outlet.

B. Sizes 5 in. and Smaller, Y-Pattern Strainer: 125 psig working pressure; flanged ends for NPS 2-1/2 in. and larger, threaded connections for NPS 2 in. and smaller, bolted cover, perforated stainless steel basket and bottom drain connection.

C. Design Equipment: Mueller.

D. Manufacturers: Elliott, Keckley, Mueller, Webster, Watts, Spirax-Sarco.

2.10 AIR VENTS

A. Manual air vents shall be a 3/4 in. ball valve with bronze body, nickel plated bronze ball, hose end, cap and chain, Watts B6000CC.

B. Automatic air vents shall be float type, 35 psig rated, Armstrong No. 502CV OR float type, 150 psig rated, Armstrong No. 75 or Spirotop. Provide unit with an appropriate rating, as necessary for location.

C. High Capacity Automatic Air Vent:

1. Cast iron body. 150 psig rated. Stainless steel float.

2.11 FLEXIBLE PIPE AND PUMP CONNECTIONS (BRAIDED STAINLESS STEEL)

A. Braided stainless steel pump and pipe connector(s) shall be constructed of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s) and a stainless steel ring-ferrule/band (material gauge not less than .048 in.) shall be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. Fittings shall be attached using a 100% circumferential TIG weld.

B. Braided stainless steel pump and pipe connector(s) must be suitable for operating temperatures up to 850°F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor.

C. Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

D. Braided stainless steel connectors shall carry a three (3) year warranty when installed in accordance with all specifications and installation instructions as described by the manufacturer.

E. End fittings shall be flat-faceplate steel flanges with 150# ANSI drilling, and outside diameter, carbon steel MPT ends, flanged by Schedule 40 grooved ends or increasing ends.

F. Acceptable Manufacturers: Flexhose Pumpsaver or equivalent Keflex, Metraflex, Mason-Mercer.

2.12 GLYCOL MAKE-UP TANK

A. Provide the following apparatus including all external piping and wiring:

1. One (1) fifty gallon polyethylene solution tank, with cover, mounted in a welding steel frame. Frame shall be furnished with an epoxy coating to resist chemical attack.

2.13 GLYCOL SOLUTION

A. The closed loop system shall contain a preblended solution of industrially inhibited propylene glycol and deionized water. The solution percent concentration shall be:

1. 40% by volume resulting in freeze (slush) protection to -3°F or lower, and burst protection to -35°F or lower

B. The solution must be blended with deionized water and must meet the following criteria:

1. Nitrate: 1500 ppm
2. Tolytriazole: 20 ppm
3. Water: Balance (water to be added to glycol solution shall meet manufacturers standard for quality)
4. Color: Olive Green

C. The selected coolant must meet ASTM D8039 Standard Specification for Heat Transfer Fluids (HTF) for Heating and Air Conditioning (HVAC) Systems.

D. The selected coolant must meet or exceed the ASTM D8040 Standard Test Method for Corrosion Test for Heat Transfer Fluids in Glassware. The supplier prior to delivery must provide a Certificate of Assurance.

E. The solution shall contain a fluorescent dye to facilitate easy leak detection.

F. Approved Coolant Manufacturers are:

1. Metro PG#36

2. Dow Chemical Company Dowfrost HD - Propylene Glycol.

3. Interstate Chemical Company INTERCOOL NFP - Propylene Glycol.

4. Interstate Chemical Company INTERCOOL NFP 50 AA and NFP-40 AA (For boilers and other equipment with aluminum alloy heat exchangers).

5. NOCO Innovative Industrial Solutions MAXTECH Heat Transfer Fluid

6. NOCO Innovative Industrial Solutions MAXTECH AL-Safe Heat Transfer Fluid

G. The use of ethylene glycol is strictly prohibited.

2.14 CHEMICAL POT FEEDER

A. 2 gallon carbon steel body, domed bottom, powder coated finish, rated for 320 psi at 250°F.

B. Funnel kit with sealed safety bar closure cap rated for design pressure. Furnish with pedestal mounted legs. Provide site glass with damage guard and associated isolation valves. Provide air vent with air release valve.

C. Design make: Griswold.

D. Makes: Griswold, Neptune, Wessels.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Obtain detailed instructions from each manufacturer for proper method of installation.

3.2 SYSTEM FILLING

A. After cleaning, fill each system from low point.

B. With pumps off, vent mains, risers, run-outs, and units, working consecutively from low to high point of building. Obtain approximately 2 psi at highest point. Obtain proper air cushion in compression/expansion tanks.

3.3 AIR VENTING

A. Provide where specifically called for in piping details and at all points in piping systems where air may collect due to changes in piping elevation.

1. Manual air vent assembly consisting of 1-1/4 in. x 4 in. air collection chamber with 3/4 in. hose end ball valve with cap and chain.

2. Automatic air vent with a ball valve for the purpose of isolation and service or replacement. Do not use automatic vents on chilled water and glycol service; use manual vents only.

3. Unless otherwise indicated, automatic air vents shall only be installed in Mechanical Rooms. Pipe high capacity air vent discharge down to floor.

B. Equipment Vents:

1. When equipment is above mains: Connect run-outs or risers to upper quadrant or top of mains. Install vent assembly concealed within enclosure, consisting of 1 in. diameter by 4 in. to 6 in. long air collection chamber with 1/4 in. soft copper tube to manual valve. Mount securely near bottom of enclosure, but not fastened to enclosure. For individual units, radiators, fan convectors and units with return grilled: Provide screwdriver operated manual valve, operated from discharge grille or access door. Drill enclosure and position valve for operating without removing enclosure.

2. When equipment is below mains: Connect piping run-outs or risers to bottom or lower quadrant of mains. Vent assembly not required in unit. Provide means of purging and draining each unit if required. Use tees instead of ells at low point of run-outs.

3.4 AIR SEPARATOR

A. Provide supports and provide blow-down with hose end drain valve. Hang unit from structure at an elevation low enough to allow for upward pitch of piping to compression tank.

3.5 MAKE-UP WATER VALVES

A. Provide for each system, with 3/4 in. globe valve bypass connection, and check valve downstream of bypass connection. Set valves to provide 2 psi at high point of system. Provide pressure gauge assembly.

3.6 RELIEF VALVES

A. Hot Water System: Pipe discharge to floor drain and place hanger at elbow. Install piping so as not to introduce stress of PRV body.

3.7 FLOW BALANCERS

A. Where flow balancers are smaller than pipe line size, provide reducers directly adjacent to flow balancers.

B. Provide on each hydronic unit and where called for. Meter connection points shall not point downward.

3.8 SUCTION DIFFUSERS

A. Provide at inlet to base mounted pump.

B. Pipe suction diffuser blow-off connection (full size with ball valve) to nearest floor drain.

3.9 STRAINERS

A. Install strainers on supply side of each control valve, pressure reducing valve, solenoid valve, in-line pump and elsewhere as indicated. Install NPS 3/4 in. nipple and ball valve in blowdown connection of strainers NPS 2 in. and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 in.

3.10 GLYCOL MAKE-UP TANK

A. Set unit on a 6 in. concrete pad.

B. Pipe all relief valves to solution tank.

3.11 GLYCOL SOLUTION

A. The Coolant Manufacturer shall analyze the fluid two (2) times during the warranty period to ensure the glycol water solution continues to provide corrosion protection within industry standards and at no cost to the Owner.

B. No chemical additions shall be made to the glycol water solution until the Coolant Manufacturer has completed an analysis. Should such a chemical addition be required, it will be done in accordance with the recommendations on the analyticals as supplied by the manufacturer.

C. The Mechanical Contractor shall meter the initial water fill for the purpose of hydrostatic pressure testing and/or system flushing. After completion of this requirement, the water shall be metered out. This will provide the contractor with a precise measure of coolant required to fill the system as well as the amount of water trapped in the system. This process will allow for any adjustments required prior to delivery of the premixed glycol solution and ensure that the solution strength is in compliance with the specification.

D. Should the concentration still require adjustment after the system has been filled and as a result of trapped water, then drain the required amount of fluid from the system and replace it with the same manufacturer's coolant in its concentrated form. Repeat this process until compliance with this specification is achieved.

END OF SECTION

SECTION 232123 - PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required, for the complete installation designed in Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230513 - Motors

1.3 SUBMITTALS

A. Shop drawings and performance curves, on pumps and pump accessories clearly indicate which equipment is being submitted.

B. Provide catalog information on motors as specified in section 230513.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Pumps shall be non-overloading over their entire performance range with motors capable of running continuously without undue noise, heating, or sparking. Impellers shall be statically and dynamically balanced. Provide mechanical seals for closed systems, constructed of carbon rings with ceramic mating seat up to 220°F. Provide packing type seals for open systems only. Provide materials suitable for water pressures, temperature and conditions for each application. Provide tapped discharges and suction connections for gauges, vent and drain. Provide factory trimmed impeller if required, to meet initial delivery requirements.

B. Provide the services of a factory service engineer or machinist to check each pump alignment before pump is started, using laser equipment.

C. Motors shall be provided by equipment manufacturer and conforming to all requirements of specification Section 230513

2.2 SELECTION CRITERIA

A. Pumps shall be non-overloading over their entire performance ranges, with trimmed impeller as required to meet initial delivery requirements. Pump selection shall not take into account, or infringe on the service factor of the motor.

B. Select pumps at appoint within the maximum efficiency for a given impeller casing combustion. Deviations within 3 percent of maximum efficiency are permissible, provided that the lesser efficiency is not less than the scheduled efficiency.

C. Pumps may not be selected such that the impeller diameter is larger than 90 percent of the published maximum diameter for the casing using smaller equipment than the scheduled equipment.

2.3 BASE MOUNTED END SUCTION TYPE

A. Designed for continuous operation between 40° and 225°. Single stage, end suction, bronze fitted, with cast iron volute for service to 175 psi wp. Enclosed bronze impeller mounted on a hardened, alloy steel shaft with regreasible ball bearings. Pump shall be direct connected to the drive motor by means of a rubber insert, flexible coupling with ANSI/OSHA guard. Pump and motor shall be mounted on a groutable structural steel main-frame with welded cross members. Pumps used in a variable speed pumping system shall contain couplings suitable for very low and intermittent torque loads.

B. Design Equipment: Bell & Gossett Series e-1510.

C. Acceptable Make: Armstrong, Bell & Gossett, Grundfos CBS.

2.4 IN-LINE CENTRIFUGAL PUMPS

A. Designed for continuous operation between 40° and 225°F. In-line, close-coupled, single stage, bronze fitted construction. All pump internals shall be capable of being serviced without disturbing piping connections. Replaceable shaft sleeves at the seal or packing. Enclosed type impeller, keyed to the shaft and secured by a locking capscrew. Factory guaranteed operating performance. Pumps used in a variable speed pumping system shall contain couplings suitable for very low and intermittent torque loads.

B. Design Equipment: Bell & Gossett, Series e-90.

C. Make: Armstrong, Bell & Gossett, Grundfos CBS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

C. Provide 6 in. concrete pad for each base mounted pump. Level base so that pump and pump casing are not strained. Align pumps as directed by manufacturer. After pumps have been aligned, install dowels to prevent shifting. Fill base with non-shrink grout through grouting holes provided in baseplate. Contractor responsible for accurate size of base and exact location of mounting bolts. Contractor responsible for trouble resulting from poor pump alignment.

D. Base mounted end suction pumps shall be provided with inlet suction diffusers where shown on drawings. Pipe suction diffuser blow-off (full line size with ball valve) to nearest floor drain. Provide start-up strainers for first 48 hours of operation. Replace after completion of start-up period.

E. In-line pumps shall be installed using continuous-thread, hanger rods and elastomeric hangers of size required to support weight of in-line pumps.

F. Provide inertia bases as specified, determine exact height of bases required for base mounted elbows; shim to match mounting height of base elbow with inlet and outlet of pump. Refer to Specification Section 230548 for additional details.

3.2 ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment services for all pumps that use a coupler attached to the device train, whether base mounted or inline mounted. Alignment shall be accomplished with a laser shaft alignment system.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

E. Provide an alignment report indicating alignment setup data, tolerances and final results.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Check piping connections for tightness.

3. Clean strainers on suction piping.

4. Perform the following startup checks for each pump before starting:

a. Verify bearing lubrication.

b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.

6. Start motor.

B. Open discharge valve slowly.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION

SECTION 233100 - SHEET METAL AND DUCTWORK ACCESSORIES CONSTRUCTION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 QUALITY ASSURANCE

A. Ductwork shall be fabricated and installed in compliance with latest edition of the following standards and with the edition of the Codes in effect at the time the building permit is obtained.

1. SMACNA Duct Construction Standards - Metal and Flexible Ductwork.

2. SMACNA Duct Liner Application Standard.

3. SMACNA HVAC Air Duct Leakage Test Manual.

4. Mechanical Code of New York State.

5. Energy Conservation Construction Code of New York State.

6. Plans and Specifications which exceed the requirements in any of the referenced standards.

B. All sheet metal shall be fabricated and installed by an experienced Contractor specializing in this type of work.

C. All ductwork and fittings shall have a computer generated label affixed to the exterior surface of each section, detailing all applicable information including the duct dimensions, gauge, reinforcement type/class and connection type by systems manufacturer. Galvanizing thickness shall be clearly stenciled on each duct section.

D. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

1.3 SUBMITTALS

A. Submit a complete shop standard manual including miscellaneous materials, and construction details for all shop fabricated materials including, but not limited to, volume dampers, turning vanes, duct sealant, equipment flexible connections, access doors, flexible duct, acoustical duct lining, etc.

B. Ductwork Shop Drawings

1. Prepare minimum 1/4 in. scale drawings:

a. Detailed ductwork shop drawings shall include size, layouts and pressure classifications. Any ductwork installed without benefit of review by the Engineer of Record may be subject to replacement at the expense of the Contractor.

b. Constructed from actual field inspections and measurements so as to assure a complete job.

c. Incorporate dimensions of actual equipment proposed for use on the project.

d. Showing adequate sections, elevations, and plan views and indicating the bottom of ductwork elevations from the finished floor.

e. Indicating all volume dampers, fire dampers, smoke dampers, damper access doors and other accessories required for a completed project.

f. Indicate roof, wall and floor opening dimensions and locations shown on shop drawings.

g. Indicate the location of the duct smoke detectors, increase duct size, ensure the minimum straight ductwork upstream or/and downstream at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size required with Division 28 "Electronic Safety and Security".

2. Call to the attention of the Engineer immediately, any major deviations from the Contract Drawings, which must be made. All deviations shall be documented in writing. Resubmit with corrections for final Engineer review.

C. Prepare a duct pressure testing report similar to that suggested by SMACNA and submit for review. Duct testing shall be conducted in the presence of the Owner's Representative. Provide test reports indicating pressure tests performed. Include date, a ductwork approved shop drawings sheet with the section tested highlighted, test pressure and leakage rate.

1.4 GENERAL

A. All adhesives, sealants, primers and paint used for ductwork in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

1.5 DUCTWORK CLASSIFICATION

A. Duct systems are to be classified and constructed per the SMACNA Velocity-Pressure classification system as follows:

1. All ductwork shall be constructed for a minimum pressure class of 2 in. w.g., unless stated otherwise, for the following systems, as applicable:

a. Supply duct downstream of terminal units.

b. Typical low pressure supply ductwork.

c. Typical return ductwork.

d. Typical low pressure exhaust ductwork.

2. Supply duct upstream of terminal units shall be constructed for a minimum pressure class of 3 in. w.g., unless otherwise stated, or required as per below.

3. Pressure classes above 3 in. w.g. shall be provided as follows, based upon the external static pressure as scheduled for each specific fan.

Scheduled External Static Pressure	**Pressure Class**
Over 3 in. up to 4 in. w.g.	4 in. w.g.
Over 4 in. up to 6 in. w.g.	6 in. w.g.
Over 6 in. up to 10 in. w.g.	10 in. w.g.

B. Any new ductwork connected to existing systems must adhere to the requirements outlined above. Contractors are responsible for verifying the maximum static pressure of the existing systems to determine the appropriate pressure class for the new ductwork. Inform Owner’s Representative and Engineer of any unknown conditions or discrepancies.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. See Exhibit at the end of this section for where sheetmetal materials shall be applied, and remarks.

1. Galvanized Sheet Steel: Comply with ASTM A653 and A924, with G90/Z275 coating.

2. Stainless Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in Exhibit "I"; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D or No. 3 as indicated in Exhibit "I".

3. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

4. Gauges per SMACNA HVAC Duct Construction Standards, Metal and Flexible.

B. Make: Semco, United Sheet Metal, unless noted otherwise, or approved equal.

2.2 SQUARE AND RECTANGULAR DUCTWORK

A. Transverse and longitudinal duct seams reinforcement shall conform to appropriate tables and figures per SMACNA Velocity-Pressure Classification for duct construction.

1. Transverse joints shall be sealed with duct joint sealant. "Ductmate" or "Nexus" 4-bolt connection systems may be used in lieu of standard construction.

2. Field assembled longitudinal seams shall be sealed with duct sealant. Factory or shop fabricated rolled or machine pressed longitudinal seams does not require sealant.

B. Corner closures shall be required as described and illustrated by SMACNA Duct Construction Standards.

C. Throat radius on all elbows shall not be less than the dimension of the duct plane of radius. Where this cannot be maintained, use shorter radius with internal guide vanes, or square elbow with turning vanes.

D. Bracing and hanging of ductwork shall be per SMACNA Standards for size and system class of ductwork being used.

E. Any transformations shall not reduce the ductwork cross-sectional area. Maximum angle in straight duct, 20° for diverging flow and 30° for contraction flow. Transformation from square to round seams welded or brazed.

2.3 ROUND DUCTWORK

A. Standard Round Ductwork:

1. All spiral ducts shall have locked seams so made as to eliminate leakage under pressure for which this system has been designed. Longitudinal seams duct shall have fusion-welded butt seams.

2. No stovepipe will be allowed.

3. Round Ductwork Fittings:

a. All fittings fabricated per SMACNA Standards for round ductwork, material to match straight pieces of ductwork.

b. Fittings shall have continuous, welded seams.

c. 90° tees shall be conical type. 90° tees and 45° laterals up to and including 12 in. diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming. The entrance shall be free of any restrictions.

d. Round taps off the bottom of rectangular ducts down to diffusers shall be made with a 45° square to round shoe-tap.

4. Elbows:

a. Diameters 3 in. through 8 in.: Two-section stamped and continuously welded elbows, material to match straight pieces of ductwork.

b. Over 8 in.: Gored construction with standing seam construction and internally sealed or continuously welded. Less than 35° - two gores, 36° to 71° - three gores, over 71° - five gores.

c. Fabricated to a centerline radius of 1.5 times the cross-section diameter.

d. Adjustable elbows are not allowed.

5. Joints:

a. For duct construction pressure 3 in. w.g. or greater:

1) Round Joints:

a) Unexposed Duct 3 in. - 30 in. Diameter: Connect round duct with a one piece interior slip coupling, at least two gauges heavier than duct wall, beaded at center and fastener to duct with screws. Seal joint with an approved sealant applied continuously around both end of coupler prior to assembling and after fastening.

b) All Exposed Duct and Unexposed Duct 30 in. - 72 in. Diameter: Install using a three piece, gasket flanged-joint consisting of two internal flanges, with integral mastic sealant, and one external closure band, which compress the gasket between the internal flanges.

(1) Acceptable Manufacturer: Ductmate Industries "Spiralmate" system or approved equal.

c) Above 72 in. Diameter: Install using companion angle flanged joints as defined in Figure 3-1 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible" Third Edition. Refer to manual for proper sizing and construction details.

d) Dust collection systems and exposed duct 3 in. - 14 in. use a one piece, polyethylene lined gasket connector with integrated bolt for the closure system.

(1) Acceptable Manufacturer: Ductmate Industries "Quicksleeve" or approved equal.

b. Pipe-to-pipe joints in diameters up to 60 in. shall be by the use of sleeve couplings, reinforced by rolled beads.

c. Pipe-to-fitting joints in diameters up to 60 in. shall be by slip-fit of projecting collar of the fitting into the pipe.

d. Insertion length of sleeve coupling and fitting collar shall be 2 in. up to 36 in. diameter and 4 in. above 36 in. diameter.

e. Pipe-to-pipe and pipe-to-fitting connections in ductwork above 60 in. in diameter shall be made by angle ring flanges. The flange on the pipe shall be a 2 in. x 2 in. x 3/16 in. angle attached to the pipe with a continuous weld. The fittings shall have a loose ring "Van Stone" flange. A 5/8 in. flange shall be provided to act as a gasketing surface for sealing with the angle ring being a rolled, welded ring 2 in. x 2 in. x 3/16 in. Bolt hole spacing for angle rings shall be 6 in. centers.

f. If longitudinal seam duct greater than 60 in. in diameter is supplied in lengths greater than 4 ft., one angle ring must be welded to the duct on 4 ft. centers for support.

2.4 DUCTWORK SEALING

A. SMACNA Duct Sealing Classification shall be used for duct systems using the following criteria:

1. Ductwork and all plenums with pressure class ratings shall be constructed to seal Class A, as required to meet the requirements of SMACNA Duct Construction Standards and with standard industry practice, including transverse joints, longitudinal seams, fitting connections, and all penetrations of the duct wall.

2. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage. Pressure sensitive tape or sealing compounds shall not be used. Sealing compounds used to seal openings for rotating shafts shall not be used.

3. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels and duct connections to equipment.

4. Sealing that would void product listings is not required.

5. Spiral lock seams need not be sealed.

B. Sealants and tapes shall be listed and labeled in accordance with UL 181A or UL181B and marked according to type, and per manufacturer product requirements for associated system and application/installation location.

1. Duct sealant for indoor applications shall be non-fibrated, water based, Hardcast Iron-Grip IG-601, Ductmate PRO Seal, Foster 32-17 or Childers CP146, or approved equal.

2. Duct sealant for outdoor applications shall be fibrated, water based, Hardcast Versa-Grip VG-102, Ductmate Fiberseal, Foster 32-17 or Childers CP148, or approved equal.

2.5 TURNING VANES

A. Provide in mitered elbows as shown on contract drawings. Vanes 36 in. or longer shall be double wall air foil type. All turning vanes shall be installed as per the latest SMACNA Standards. Turning vane size and spacing shall be as per SMACNA. Turning vane spacing greater than SMACNA Standards is not acceptable.

B. Turning vanes shall be Harper or equivalent double wall turning vanes fabricated from the same material as the duct.

C. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vane shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer's instructions.

D. Rails for mounting turning vanes shall have self locking, friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in Figure 4-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible". Rail systems with non-compliant tab spacing shall not be accepted.

E. Acoustical Turning Vane: Shall be used in applications that require quiet operating systems. Mounting rails shall have friction insert tabs that align the vanes automatically.

F. Acceptable Manufacturer: Ductmate Industries PRO-Rail Turning Vane or approved equal.

2.6 DAMPERS IN DUCTWORK

A. Blade Type Volume Dampers: Constructed per SMACNA, one gauge heavier than duct material, securely fastened to 3/8 in. sq., cold rolled steel operator rod. Provide stainless steel operator rod in stainless steel ductwork. Provide Ventlock 639 elevated dial regulator for 2 in. insulated ductwork or equal. Provide Ventlock 635 dial regulator for non-insulated ductwork or equal.

B. Multiple Blade Type Volume Dampers: Provide multiple blade volume dampers in ductwork above 12 in. in height.

1. Heavy duty, manual balancing dampers suitable for application in HVAC systems with velocities to 1,500 ft. per minute, open position and max. pressure of 3 in. w.g. close position. Ruskin MD 35 or equivalent.

2. Fabrication:

a. Frame: 5 in. x minimum 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel.

3. Blades:

a. Style: Single skin with 3 longitudinal grooves.

b. Action: Opposed.

c. Orientation: Horizontal

d. Material: Minimum 16 gauge equivalent thickness, galvanized steel.

e. Width: Nominal 6 in.

4. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.

5. Linkage: Concealed in frame.

6. Axles: Minimum 1/2 in. diameter, plated steel, hex-shaped, mechanically attached to blade.

7. Control Shaft: 3/8 in. square plated steel.

8. Finish: Mill galvanized.

a. Actuator: Hand quadrant for 3/8 in. square extended shaft.

b. Hand Quadrant Standoff Bracket: 2 in. standoff for insulated ductwork.

c. Oillite bearings.

d. Factory Sleeve: Minimum 20 gauge thickness, minimum 12 in. length.

C. Automatic Air Dampers: Furnished as part of "Building Management System" Section 230923, and installed by this Contractor.

2.7 FLEXIBLE AIR DUCTS

A. Flexible air ducts and connectors shall be constructed in compliance with NFPA Bulletin 90A, 90B and UL Standard 181 and shall be listed and labeled as Class I Air Duct.

B. Flexible air ducts and connectors shall be tri-laminate:

1. Consisting of corrosion resistant galvanized steel helix encapsulated by a double lamination of polyethylene or spun bond nylon.

2. Factory applied (R 6.0) fiberglass exterior insulation, sheathed in a seamless, tri-directionally reinforced, metalized polyester, exterior vapor barrier.

3. R-value shall be classified by Underwriters Laboratories, and certified by the Air Diffusion Council, in accordance with ADC Flexible Duct Performance and Installation Standard (1991), using ASTM C-518, at installed wall thickness, on flat insulation only. Comply with ASHRAE/IESNA 90.1.

4. Recommended operating pressure for flexible ductwork shall be three times maximum system press but not less than 6 in. w.g. positive pressure for 4 in. - 20 in. dia., 5 in. w.g. negative pressure through 16 in. dia., 1 in. negative pressure for 18 in. and 20 in. dia. Maximum velocity of 5500 fpm.

5. Operating temperature range - 20°F to 250°F, intermittent @1/2 in. pos. w.g. max., -20°F to 140°F, continuous at maximum pressure.

6. Flame Spread: 25 max. smoke developed rating: 50 max.

7. Porous inner core flexible duct shall not be used.

C. Static pressure and thermal performance shall be tested and certified in accordance with Air Diffusion Council (ADC) Test Code FD-72-R1 under conditions of 140°F for 164 hours and 180°F for 4 hours.

D. Acoustical performance shall be certified in accordance with ASTM E 477 and/or Air Diffusion Council Test Code FD-72-R1.

1. Minimum Acoustic Performance:

a. The insertion loss (dB) of a 6 foot length of duct when tested in accordance with ASTM E477 at a velocity of 1000 feet per minute shall be at least:

	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
8 inch dia.	26	27	27	31	32	27
12 inch dia	22	26	24	31	31	20

E. Friction loss and leakage for flexible duct only shall be certified in accordance with Air Diffusion Council Test Code FD-72-R1. Leakage for connections shall be accordance with UL 181 requirements.

F. Basis-of-Design: Flexmaster 6B (R-6.0).

G. Acceptable Manufacturers:

1. Dundas-Jafine Type SPC R6.0.

2. Hart & Cooley Type F216 (R-6.0).

3. Flexible Technologies, Inc. Thermaflex Type M-KE (R-6.0).

4. Atco Rubber Products, Inc. Type 036 (R-6.0).

2.8 FLEXIBLE DUCT ELBOW SUPPORT

A. Provide flexible duct elbow support for flexible duct connected directly to a diffuser collar.

B. Elbow support shall be a radius forming brace designed to form flexible duct into a 90° elbow not less than one duct diameter in centerline radius.

C. Elbow support shall be manufactured from 100% recycled copolymer polypropylene with a universal fit of 4 in. thru 16 in. and be UL listed.

D. Basis-of-Design: Titus Flexright.

2.9 FLEXIBLE CONNECTIONS TO FANS AND EQUIPMENT

A. Basis-of-Design: Ventfabrics, Inc.

B. Acceptable Manufacturers: Ductmate Industries, Inc., Duro Dyne Inc., Elgen Manufacturing, Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Materials: Flame-retardant or noncombustible fabrics, water and mildew resistant UL Standard 214.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 in. wide attached to two (2) strips of 2-3/4-in. wide, 0.028-in. thick, galvanized sheet steel or 0.032 in. thick aluminum sheets. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.

2. Tensile Strength: 480 lbf/in. in the warp and 360 lbf/in. in the filling.

3. Service Temperature: Minus 40 to plus 200°F.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.

2. Tensile Strength: 450 lbf/in. in the warp and 340 lbf/in. in the filling.

H. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-in. movement at start and stop.

2.10 FLEXIBLE PVC HOSE

A. Flexible PVC hose shall be constructed in compliance UL Standard 94V-0.

B. Basis-of-Design: BLO-R-Vac McMaster-Carr Part No. 566K46 (12 in. duct).

C. Materials: Flame-retardant, flexible PVC with metal spiral.

D. Size: Refer to plans.

E. Color: Blue.

2.11 ACCESS DOORS

A. General:

1. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

2. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.

3. Systems 3 in. w.g. or less shall utilize a hinged, cam, or hinged and cam square framed access door.

4. Systems 4 in. w.g. and above shall utilize a sandwich type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Third Edition.

5. Approved Manufacturer: Ductmate Industries "Sandwich" style door or approved equal.

6. All access doors shall be continuous piano hinged type, unless noted otherwise.

7. Non-hinged only allowed where clearance to ceiling does not allow a full 90° swing.

8. Double panel insulated type when used in insulated duct.

9. Single panel uninsulated type allowed in un-insulated duct.

10. Pressure rated according to system in which being installed. Door-to-frame and frame-to-duct gasketing.

11. Provide specified Seal Class A or B ductwork sealing around frame, and hand adjust the latch tension for proper seal, on all access doors other than sandwich panel (Ductmate) style.

12. MINIMUM access door size for ducts 12 in. or less in depth is 12 in. x 8 in.

13. MINIMUM access door size for ducts 12 in. to 18 in. in depth is 18 in. x 14 in.

14. MINIMUM access door size for ducts more than 18 in. in depth is 24 in. x 18 in.

15. In ducts which require multiple section fire dampers due to duct size, provide one access door for each fire damper section.

16. Access doors for fire and smoke dampers shall be permanently labeled with 1/2 in. high lettering reading "SMOKE DAMPER" or "FIRE DAMPER".

B. Door Types:

1. Low Pressure Systems (2 in. w.g. pressure class): National Controlled Air ADH-1, Ruskin ADH22, Vent Products 9701, Air Balance FSA-100, Safe Air SAH, Nailor.

2. Medium and High Pressure Systems (3 in. w.g. pressure class and higher):

a. Rectangular Duct: Ductmate Industries "Ultimate" Style Door, or equal.

b. Round Duct: Ductmate Industries Round Sandwich type, or equal. 8 in. x 4 in. for ducts 14 in. and less in diameter. Ductmate Industries Round Sandwich type 16 in. x 12 in. for ducts more than 14 in. in diameter.

c. Furnish and install factory supplied protector molding on cut medal edge for all Ductmate access doors.

3. Doors In Outside Air Plenums: 18 gauge galvanized steel double wall door with 2 inch polyurethane foam insulation, continuous piano hinge, outswing type, Allegis latches (minimum two (2) latches per door), fully gasketed. Size as indicate on plans. AJ Door, or approved equal.

2.12 EXHAUST HOODS AND HOOD CONNECTIONS

A. General Requirements:

1. Provide hoods and duct connections.

2. Duct material, thickness and joints as required for gases and vapors involved and per SMACNA.

B. Canopy Hoods:

1. Wall mounted hood shall be 18 gauge, 304 stainless steel, #3 polished finish, continuously welded, liquid tight construction. All welds shall be polished to match original finish of material. Hood to include full perimeter condensate gutter with welded drain fitting. Ductwork opening field cut. Top enclosure where noted in schedule.

2. Refer to schedule for dimensions.

3. Support from building structural members.

4. Basis-of-Design: Kees KG.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Ventlock 699 or 699-2 based upon insulation thickness.

C. Install duct test holes where required for duct traverse testing and balancing purposes.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Equipment and systems shall be installed in accordance with local and state codes and regulations having jurisdiction. Bracing and hanging of ductwork shall be per SMACNA - HVAC Duct Construction Standard.

B. Install all ductwork concealed and tight to the structure above unless noted otherwise on shop drawings. Fabricate only after the approval of shop drawings, and in locations to avoid interferences.

1. Ductwork installed without approved shop drawings, which requires removal/modification and/or reinstallation due to conflicts or improper installation shall be repaired at no cost to the Owner.

C. Sizes given on contract drawings are inside dimensions.

D. The ductwork sizes and types (round and rectangular) were selected for space limitation and acoustical requiremetns within the building. In addition, the ductwork sizes and types were chosen to allow space above the ceilings for future ductwork, piping and/or conduit. It is not acceptable for the contractor to change the size or type of ductwork for bidding or installation unless specifically approved by the engineer.

E. Keep openings continuously closed and sealed with protective plastic wrapping during construction to prevent entrance of dirt and debris.

F. Extend access openings, damper rods and levers, to outside of external insulation make systems airtight.

G. No piping, conduit or other obstruction to airflow is permitted in ductwork.

H. Provide necessary openings, hanger inserts, framing, chases, and recesses, not provided by other trades.

I. Exposed exhaust or return registers and grilles shall be flush with face of duct; exposed supply registers and grilles shall be mounted outside airstream with 45° shoe-tap extension collars.

J. Provide 14 gauge sleeves for ducts passing through Mechanical Room floors. Set sleeves 4 in. above finished floor in Mechanical Rooms, seal watertight to floor.

K. Where a supply, return or exhaust duct is shown to be left open ended, provide hardware 0.5inch aluminum mesh screen at opening.

L. Do not utilize flexible ductwork or connection in any way to connect variable or constant volume boxes to ductwork.

M. Penetrations:

1. Provide 14 gauge sleeves for ducts passing through Mechanical Room floors. Set sleeves 4 in. above finished floor in Mechanical Rooms, seal watertight to floor.

2. For duct penetrations of non-rated walls, provide sheet metal angle framing or sheet metal closure panels around the entire perimeter of each duct wall penetration on both sides of the wall, where the gap exceeds 1/4 inch. Where the gap is less than 1/4 inch, the gap may be caulked on both sides of the wall. Non-rated wall penetrations SHALL NOT be fire caulked under any circumstances.

3. For duct penetrations of rated walls, see Specification Section 230500 - Basic Mechanical and Electrical Requirements.

N. Ductwork that is called for to be welded shall be fully welded, continuous around the entire perimeter at all joints/seams, and shall be fully airtight and watertight.

3.2 TEST OF DUCTWORK

A. Conduct duct leakage tests per SMACNA "HVAC Air Duct Leakage Test Manual" and per the requirements of the Energy Conservation Construction Code of New York State, for ductwork systems as indicated below. Positive pressure leakage testing is acceptable for negative pressure ductwork. The rate of air leakage (CL) must be less than or equal to 4.0 for rectangular ductwork and 2.0 for round ductwork, as determined by the equation in the code referenced above, which reads: $CL=F/P^{0.65}$ where F = measured leakage rate in CFM per 100 sq. ft. of duct surface, and P = static pressure of the test. When leakage above stated limits occurs, ascertain location of leaks and rebuild, repair, or seal the ductwork as required. Repeat tests as required to obtain allowable leakage rates. Prepare a report similar to that suggested by SMACNA and submit for review.

B. Leakage testing shall be witnessed by representatives from Cornell University.

C. Systems designed to operate at static pressures of 3.0" w.c. and below: All duct mains, duct sub-mains, duct branch mains, and duct risers shall be leak tested. If any of the duct sections fail the leakage test, the entire system shall be re-tested until it passes. Duct mains and sub-mains shall include all supply and return ductwork from an air handling unit, to the space(s) served. Branch ducts to terminal units, diffusers and grilles do not require testing, and pressure testing should be done prior to making the branch duct connections.

1. A duct main is defined as a duct containing the system's total airflow.

2. A duct sub-main is defined as a duct containing part of the system's airflow and serving two or more duct branch mains.

3. A duct branch main is defined as a duct serving two or more terminals.

4. A branch duct is defined as a duct serving a single terminal.

5. A terminal unit is defined as a VAV terminal.

D. Provide test reports indicating pressure tests performed. Include date, approved shop drawings with the section tested highlighted, test pressure and leakage rate.

E. Ductwork not required to be tested for leakage, shall be checked and guaranteed to meet the standards of the specified SMACNA Duct Seal Class A. All joints and connections on this ductwork shall be sealed using the approved ductwork sealant. Air balancing and testing shall be used to determine satisfactory operation of duct systems. Balancing reports indicating excessive leakage amounts shall be required to rebuild, repair or seal ductwork having excessive leakage.

3.3 INSTALLATION OF ROUND DUCTWORK

A. Use factory-fabricated couplings for joints.

B. After the joint is slipped together, sheet metal screws are placed 1/2 in. from the joint bead for mechanical strength.

C. Sealer is applied to the outside of the joint and covering the screw heads.

D. Flanged joints shall be made with neoprene rubber gaskets.

3.4 DUCT SEALING

A. Preparation:

1. Clean surfaces of dirt, oil, grease and loose of foreign matter that could impair adhesion, using soap and water or solvent.

2. Allow surfaces to dry completely before proceeding.

B. Installation of Sealant System:

1. Apply sealant system to duct joints, fasteners, and seams in accordance with manufacturer's instructions.

2. Apply sealant by brush, putty knife or caulk gun, to full coverage. Remove excess adhesive immediately.

3. Completely seal duct joint, fasteners and seams without voids, to a minimum 20 mil thick wet film.

4. Apply and store at ambient temperature of 40°F to 100°F; and protect from freezing until dry.

C. Field Quality Control:

1. Allow duct sealant system to cure a minimum of 72 hours before operating the system.

2. Do not apply external duct insulation or coatings until the joints have been inspected by the Owner's Representative.

3.5 AIR AND WATERTIGHT DUCTWORK

A. Where water and snow may accumulate on ductwork or where odors or corrosive gasses may collect, ductwork and plenums shall be made watertight by soldering, brazing or welding of joints. Grade ducts down toward waste points and/or toward louvers. Provide valve and drain piping from low point to waste point.

1. Chemical fume hood exhaust.

2. Canopy hood and exhaust ductwork.

B. Test for Watertightness: Before concealment, apply water by hose to check for leaks, witnessed by Owner's Representative.

3.6 TURNING VANES

A. Install only in square elbows of equal dimensions.

B. Install as per latest SMACNA Standards.

C. Secure vane runners to duct with spot welding, riveting or sheet metal screws.

D. When installing in ductwork with internal insulation.

1. Install runners in ductwork inside insulation and bolt through insulation and duct sides, welding bolts to insure rigid installation. Provide build-outs for duct Velocity-Pressure classes above 2 in. w.g.

3.7 DAMPERS AND AIR CONTROL DEVICES

A. Provide volume dampers at all air outlets, diffusers, grilles and as noted on plans. Provide volume dampers at all low pressure supply, return and exhaust, branch ducts and as noted on the plans.

B. Provide dampers necessary to permit proper balancing of air quantities. Comply with code requirements for smoke and fire control. Prevent introduction of uncontrolled outside air into building through roof and wall openings.

C. Install all dampers furnished as part of "Building Management System" Section.

3.8 FLEXIBLE AIR DUCTS

A. "Air duct" applies to conduit or passageway for conveying air to or from heating, cooling, air conditioning or ventilating equipment but not including the plenum as defined in NFPA 90A. "Air connector" applies to conduit for transferring air between an air duct or plenum and an air terminal device or an air inlet or an air outlet as defined by the NFPA 90A.

B. For round to oval connections, provide round-oval flexible adapter.

C. Flexible air ducts and connectors shall be provided in fully extended condition, free from kinks.

D. Flexible air ducts and connectors shall not be used in systems with entering air temperatures in excess of 250°F.

E. Flexible air ducts and connectors shall use only the minimum length required to make the connection and shall be installed in the horizontal or vertical position. Flexible elbows are not acceptable. Do not exceed a maximum length of 36 in., fully extended.

F. Flexible air ducts and connectors shall use minimum 1/2 in. wide positive locking, steel worm drive clamp, or nylon plenum rated straps for joints and connections. One clamp or strap for the inside core liner and one clamp or strap for the outer jacketing. When non-metallic (nylon) straps are used, they should be listed and labeled to standard UL 181B. Fastener package should be marked UL 181 B-C.

G. Collars to which flexible duct is attached shall be beaded and a minimum of 2 in. in length. Wrap twice with UL 181 tape and secure with clamp or strap. Sleeves used for joining two sections of flexible duct shall be beaded and a minimum of 4 in. in length. The draw band shall be positioned behind the bead on the metal collar.

H. Outer vapor barrier and insulation shall be slid over inner core and collar, wrapped twice with UL 151 tape and secured with a clamp or strap.

I. Connections shall be per SMACNA "HVAC Duct Construction Standards - Metal and Flexible", Air Diffusion Council "Flexible Duct Performance and Installation Standards" and NAIMA Installation Standards.

J. Flexible duct shall be supported at manufacturer's recommended intervals, but no greater distance than 2'-6" on center and prior to all 90 degree bends. Maximum permissible sag shall be 1/2 in. per foot of support spacing. Provide a minimum of one hanger on each run of flexible duct.

K. A connection to rigid duct or equipment shall be considered a support joint. Long horizontal duct runs with sharp bends shall have additional supports before and after the bend approximately one duct diameter from the centerline of the bend.

L. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case shall the material contacting the flexible duct be less than 1-1/2 in. wide. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when the manufacturer's recommended procedures are followed.

M. The hanger shall be strapped around the flexible duct and secured to the structure above. Hangers shall not be attached to other mechanical or electrical objects. Hangers may be attached to an approved trapeze. Ceiling grid shall not be used to fabricate a trapeze. Support hangers shall be installed horizontal. Screws shall not be used to penetrate the flexible duct to attach to the hanger.

N. Provide flexible duct connections and splices in accordance with manufacturer's recommended installation instructions.

O. Seal flexible duct connections with sealing materials listed and labeled in accordance with UL 181B. Mechanically secure connections with approved clamping materials.

3.9 FLEXIBLE CONNECTIONS TO FANS AND EQUIPMENT

A. Provide flexible connections for the intake and discharge connections of duct connected to fans and air handling equipment.

B. Round connections are to be made with adhesive and metal drawbands with ends tightly bolted.

C. Rectangular connections shall be made with material securely held in grooved seam between flanges. Attach with adhesive and mechanical fasteners on 6 in. centers.

D. Connections shall be made with a minimum of 2 in. space between duct and equipment collars, installed in line, and with 1 in. excess material folded so as not to interfere with airflow through connection.

E. Mechanically fastened and sealed, with specified duct sealant, at duct and equipment connections.

3.10 DUCT CLEANLINESS AND CLEANING AFTER INSTALLATION

A. Duct Cleanliness:

1. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

2. Prior to shipment to the jobsite, all duct ends and openings must be covered with a heavy duty, dual-ply, clear polyethylene protective film. Open ends are to be kept covered during transport, storage, and installation. As ductwork is installed at the job site, open ends are to be covered to maintain cleanliness.

3. The film must be securely affixed to protect against dirt and debris, and must be translucent to facilitate inspection of interior surfaces without removing the film. The film is have a elongation rating of 600% and a break strength of 13.1 lbs./in. The film shall contain no VOC's, and shall leave no residue on duct after removal.

4. Manufacturer: Ductmate Industries ProGuard (heavy duty grade clear).

B. Cleaning After Installation:

1. Interior surfaces shall be free of dust and debris prior to initial start up. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. Any cleaning of duct systems shall comply with recommendations of NAIMA and NADCA.

2. Clean external surfaces of foreign substances that might cause corrosion, deterioration of the metal, or where ductwork is to be painted.

3. Clean debris from system before fans are turned on.

4. Keep openings continuously closed during the construction period.

5. Pay damages resulting from dirt blown on painted or other finished surfaces.

6. Repair or replace damaged fan wheels, dampers, or other system parts damaged as a result of debris.

7. Clean system as many times as required until the entire system is dirt free.

3.11 FLEXIBLE PVC HOSE

A. Provide quick release clamp for connection to fume hood and ductwork.

B. Flexible PVC hose shall be provided in fully extended condition, free from kinks when fume hood is at ADA height.

C. Flexible PVC hose shall not be used in systems with entering air temperatures in excess of 160°F.

D. Flexible PVC hose shall use only the minimum length required to make the connection and accommodate the adjustable height fume hood. Do not exceed a maximum length of 24 in., fully extended.

3.12 ACCESS DOORS

A. Provide for access to upstream side of duct mounted reheat coils, dampers, damper motors, fire dampers, smoke dampers, smoke detectors, control devices, fan bearings, and equipment requiring periodic inspection or service. Provide labels for fire and smoke dampers as called for in Part 2 - Products.

B. For ducts that are too small to install an access door of the minimum specified size, provide a 12 in. long section of removable ductwork for maintenance and inspection access. Removable ductwork shall be fastened between device requiring access and next duct section with duct flanges or Donaldson Torit clamp with PVC foam seal. For ducts that are required to be insulated, provisions shall be made to allow insulation to be easily removed and re-installed.

3.13 DUCT SUPPORTS

A. Provide per SMACNA, same material as duct. Hanger bands to extend down sides and turn under bottom 2 in. Minimum two metal screws per hanger. Angle iron on larger duct spaced per building structural system but not greater that 8 ft. Provide extra support angles as required.

B. Provide additional supports as required to support reheat coils, air terminal units, filter enclosures, and any other duct mounted equipment independent from the associated ductwork system.

3.14 SMOKE DETECTION

A. Smoke detectors shall be furnished by Division 28 " Electronic Safety and Security ". This Contractor shall install detectors located in ductwork. Clearly indicate locations of smoke detectors on the sheet metal shop drawings.

B. Increase duct size at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size required with Division 28 " Electronic Safety and Security".

EXHIBIT I - DUCTWORK MATERIALS

SERVICE	MATERIAL	SPECIAL REQUIREMENTS
Supply, return, vent, relief, outside, general exhaust, laboratory exhaust excluding fume hood exhaust	Lock forming quality, galvanized steel ASTM A653 and A924	Joints and features as called for
Fume hood exhaust (from fume hood to point of connection to the main)	Type 316 stainless steel	Braze or weld airtight/watertight
Canopy hood exhaust (from hood to connection to the main)	Type 304 stainless steel	Braze or weld airtight/watertight
Accessories, dampers and air turns	Same material and gauge as parent duct	----------
Field constructed apparatus casings	Galvanized steel ASTM 525	Sealed airtight

END OF SECTION

SECTION 233400 - FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings.

1.2 SUBMITTALS

A. Submittals shall include all fans, motors, drives, and accessories. Include all fan curves fan operating point, and sound data.

1.3 QUALITY ASSURANCE

A. Capacity, size and arrangement, static pressure, brake horsepower, component parts and accessories shall be provided as called for or scheduled. Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. The manufacturer shall guarantee sound-power level ratings not exceeding those of the design equipment. All equipment shall be statically and dynamically balanced to acceptable tolerances with weights permanently fastened. Fan wheels shall be rebalanced in the field, if necessary.

B. Pressure Classification:

Maximum Total Sp	Class
Up to 3-3/4 in. WG-STD	I
Up to 6-3/4 in. WG-STD	II
Up to 12-3/4 in. WG-STD	III

C. Motors:

1. Motor sizes shall be as scheduled. Refer to Specification Section 230513 for motor types, efficiency requirements, and acceptable motor manufacturers. All belt-driven fan motors shall be mounted on either an adjustable slide base or a pivoting base. Motors shall contain permanently lubricated sealed ball bearings.

D. Drive Systems:

1. Provide fans with belt or direct drive systems as scheduled. V-belt drives as recommended by drive manufacturer, unless otherwise specified or scheduled.

a. Size drive for 200% of motor rating when motor is 10 HP and larger. Size for 150% of motor rating when motor is less than 10 HP.

b. Motors 5 HP and larger shall be provided with a minimum of two (2) belts. All belt sets shall be matched.

c. Cast iron or cast steel pulleys.

d. Provide belt and shaft guards for each driven device. Provide openings in both the motor and fan sections of the guard so that the motor and fan speeds can be checked without removing the belt guard.

e. Belts shall be oil and heat resistant, non-static type.

f. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts.

g. All belt drive fan motor selections must include an allowance for medium drive losses as established by AMCA Publication 203.

E. Motor Pulleys:

1. 5 HP and Smaller: Adjustable type to produce 15% speed change above and below scheduled fan speed. 7-1/2 HP and Larger: Fixed type.

2. 5 HP and Smaller: "A" section, 2.6 in. minimum pitch diameter.

3. 7-1/2 HP to 20 HP: "B" section, 4.6 in. minimum pitch diameter.

4. 25 HP and Larger: "C" section 7.0 in. minimum pitch diameter.

5. Drive ratio not over 4:1.

F. Bearings:

1. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy-duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours as maximum cataloged operating speed.

G. Wheels and Propellers:

1. All wheels and propellers shall be balanced in accordance with AMCA Standard 204-96, balance quality and vibration levels for fans. Wheel shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.

2. Blades on all sizes shall be continuously welded to the backplate and deep spun inlet shroud.

3. All hubs shall be keyed and securely attached to the fan shaft.

H. Blower Shafts:

1. All blower shafts shall be AISI-C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum cataloged operating speed.

I. Vibration isolation for units shall be furnished by the fan manufacturer unless otherwise noted.

J. AMCA Type B spark resistant construction.

K. Certifications:

1. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (CUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

2. All units shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit-tested packaging.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL BLOWER/CENTRIFUGAL VENT SETS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Captiveaire, Acme, Cook, Greenheck, New York Blower, Twin City, PennBarry.

B. Ceiling Mounted, Direct Driven, Centrifugal Exhaust Fan:

1. Housing:

a. The fan housing shall be minimum 20 gauge galvanized steel and acoustically insulated.

b. Square outlet, field rotatable from horizontal to vertical discharge.

c. External electrical access.

2. Motor:

a. Motor enclosure shall be open driproof (ODP), opening in the frame body and or end brackets.

b. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase.

c. Motor shall be mounted on vibration isolators and be accessible for maintenance.

d. Thermal overload protection.

3. Grille:

a. A powder painted white polystyrene grille shall be provided as standard.

4. Wheel:

a. Wheels shall be centrifugal forward curved type, constructed of galvanized steel.

5. Accessories:

a. Disconnect switch - Factory mounted and wired.

b. Fan Speed Controller - Factory mounted and wired.

6. Basis-of-Design: Product indicated in schedule.

2.2 HIGH PLUME DILUTION BLOWERS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Twin City, Strobic Air, MK Plastics, Greenheck.

B. Construction:

1. All fasteners exposed to corrosive airstream shall be stainless steel. Fans requiring flexible connections shall not be acceptable. Fan system shall be designed for a minimum 125 mph wind load without the use of guy-wires when supplied with manufacturer's roof curb and installed per manufacturer's recommendations. Fan shall be coating shall be Phenolic. Coating shall not degrade when exposed to UV light. Fan shall be direct drive, Arrangement 4, per AMCA standards.

2. Housing: Housings shall be cylindrical, heavy-gauge, continuously welded steel for strength and rigidity. Inlets shall be fully streamlined for maximum efficiency. Housings shall be suitably braced to prevent vibration or pulsation. Punched inlet flange shall be equipped for curb cap or mixing plenum box mounting. Model shall include outlet nozzle, windband, heavy duty coated steel curb cap, access door. A coated steel or galvanized curb cap shall be included to provide for a weather-tight transition between the roof curb and the fan.

C. Fan Wheel:

1. Fan wheels shall be mixed flow design with die-formed blades designed for maximum efficiency, and quiet and stable operation. Blades shall be continuously welded to the back plate and wheel cone.

Wheels shall be statically and dynamically balanced and the complete fan assembly including motor and drive shall be test balanced at or near the operating speed at the factory prior to shipment.

D. Nozzle and Windband:

1. A nozzle and windband combination shall be provided to induce ambient airflow from outside the fan housing and increase discharge velocities to be a recommended minimum of 3,000 FPM without significantly affecting BHP requirements. The windband shall provide a minimum discharge height of 84 in. from roof surface. The fan nozzle shall be capable of efficiently handling a nozzle velocity of up to 9500 fpm. The windband and nozzle combination shall be capable of inducing air up to 270% of the fan inlet capacity.

E. Fan Inlet Air Flow Stations:

1. Material: Base and shroud to be anodized aluminum, shedder to be ABS plastic.

2. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

3. Temperature: 350°F continuous operation; 400°F intermittent operation.

4. Humidity: 0-100% continuous operation.

5. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

6. Corrosion Resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance.

7. Design Equipment: Paragon FE-1050.

8. Make: Paragon FE-1050, Air Monitor, Accutrol VorTek VTF

F. Dampers:

1. Fan Isolation and Bypass Air Dampers:

a. Dampers shall be opposed blade, unless otherwise noted on drawings, aluminum, airfoil, and low leakage type design. Leakage Class 1A at 1 in. w.g.

b. Blade and frame seals shall be of extruded silicone. Seals are to be secured in an integral slot with the aluminum extrusions.

c. Bearings shall be composed of a Celcon inner bearing fixed to an aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.

d. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

e. Dampers are to be designed for operation in temperatures ranging between -40°F and 212°F.

f. All dampers shall be arranged within the air-handling unit to allow the actuators to be installed within the enclosure of the units and not mounted at the unit exterior unless otherwise noted on drawings. All dampers to be surface mounted to allow for direct connection of actuators on drive shaft.

g. Where multiple dampers are installed end to end, satisfactory clearance shall be maintained between linkages to allow for actuator linkage connections. Actuation linkage not to be attached to face of damper. Minimum damper blade width shall be 6".

h. Design Equipment: Tamco 1500 series, except dampers exposed to unmixed outside air shall be Tamco Series 9000.

i. Make: Tamco.

j. Acceptable Makes: Tamco, Ruskin.

G. Accessories:.

1. AMCA "B" spark resistant construction per AMCA 99-0401.

2. Mounted and Wired NEMA 3R Disconnect switches.

3. 1" Deflection isolation bases.

4. Shaft grounding ring.

5. Roof curb - 24 in. tall.

6. FSNTL Isolators.

7. Special coatings (Phenolic) on airstream parts.

8. Weather cowls and bypass dampers.

9. Flexible connectors.

10. Fan Inlet Air Flow Stations

H. Basis-of-Design: Twin City.

2.3 DESTRATIFICATION FANS

A. Manufacturers: Subject to compliance with requirements of this section. Basis of Design: Airius, models as noted on drawings.

B. Variable Speed Destratification Fan

1. Construction

a. Double wall construction with UV treated, flame-resistant plastic.

b. Intake safety grille.

c. Blades to be constructed of PA6 glass-fiber reinforced plastic with serrated trailing edge and winglet.

d. External rotor motor with thermal overload protection. 30,000 to 40,000 hour lubricated service life.

e. 115/1 power, 46 watts, 670 cfm of airflow.

2. Accessories

a. Exhaust safety grille.

b. 8'-0" main cable with 3/8" threaded end, Gripple mounting hardware.

c. 12'-0" stabilization tether with eye hook and Gripple mounting hardware.

d. Microprocessor variable speed controller and space sensors. Controller shall be an autotransformer based microprocessor controller with two O-10VDC inputs; one input for BMS integration and the other input for connecting to user interface. Controller can be operated in manual, automatic or bus modes. The automatic mode is configurable for various heights and utilizes dedicated temperature sensors that enable automatic adjustments to fan speed based on the temperature differential between these sensors. Electrical input is AC single-phase.

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

A. Provide equipment in accordance with manufacturer's instructions. All fans shall meet the intent of the system performance requirements. Provide rubber in-shear vibration isolation for all fans unless otherwise called for. Provide necessary support steel for equipment. Provide guards for all exposed belts, shafts, and fan wheels. Change pulley sizes or adjust sheaves as required to make systems deliver specified quantities of air as listed on the Contract Drawings.

B. Install fans as indicated on the contract drawings.

C. Pipe High Plume Dilution Blower housing drain to the nearest drain.

D. Rooftop Fan or Fan/Plenum assembly shall be mounted on a structural support curb with a specified height as shown on the drawings. Roof curb shall be insulated and fabricated of a minimum 14 Ga. structurally reinforced galvanized steel. Refer to specification 230530.

E. Vibration isolation shall be limited to neoprene vibration pads for High Plume Dilution Blower.

F. Install fans in accordance with manufacturer's instructions, applicable specification and code requirements.

END OF SECTION

SECTION 233600 - VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Drawings.

1.2 SUBMITTALS

A. Submit product data for terminal units including room number, maximum and minimum CFM, accessories, pressure drops, discharge and sound power data by octave band. Clearly indicate box sizes being proposed.

PART 2 - PRODUCTS

2.1 TERMINAL UNITS

A. General Unit Construction:

1. Unit casing shall be constructed of 22 gauge welded galvanized steel. Factory label each unit with size, location, minimum and maximum CFM, and calibration chart. Air terminal units shall be capable of operating at 10 in. w.g., pressure maximum without damage. Maximum casing leakage at 3 in. W.G. shall be 11 cfm.

2. Unit insulation liner shall comply with the requirements of UL 181 (erosion, mold growth and humidity) and ASHRAE 62.1, and shall have a maximum flame/smoke spread of 25/50 for both the insulation and the adhesive when tested in accordance with ASTM E84. Insulation shall be secured with adhesive. Liner shall be:

   a. Fiber-free foam insulation 1 in. thick (R4.0)

3. Units to be certified under ARI Standard 880-94 Certification Program and carry ARI seal.

4. Units to be provided with a factory control enclosure suitable for field installed controls.

5. Units shall be provided with factory access door option.

6. Units shall be provided with 3 ft. integral sound attenuators, where noted.

B. Control and Volume Regulating Devices:

1. Internal unit damper shall be constructed of galvanized steel with blade-end seals for tight shut-off with a maximum damper leakage of 7 CFM against a maximum of 3 in. w.g. Damper shall be mounted on a galvanized steel shaft extending through the unit on torque free bearings. Terminal shall have normally open dampers. Minimum and maximum air quantities shall be factory set, but may be field adjustable. Neither the radiated or discharge sound power levels shall exceed the ratings of design equipment as scheduled on the Contract Drawings.

C. Hydronic Reheat Coil:

1. Coil shall be factory installed on the terminal unit and shall be constructed of 1/2 in. copper tube with aluminum plate fins, non ferrous headers and connections. Tested at the factory to 250 PSI hydrostatic pressure. Control valves shall be provided by the temperature control subcontractor as described in Section 230923. Output capacity and rows as scheduled on the Contract Drawings.

D. Terminal Volume Controller (Microprocessor Based):

1. Provide unit with airflow velocity and total pressure sensor suitable for up to 3000 fpm inlet velocity. Sensor shall be averaging type with multiple sampling points on cross grids.

2. Wall mounted thermistor type electric space sensor provided by Control subcontractor.

3. The VAV box manufacturer shall provide the box and the airflow sensor. The temperature control subcontractor shall field install the microprocessor based controller and damper motor.

E. Design Equipment: Titus DESV.

F. Acceptable Makes: Anemostat, Krueger, Titus.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Suspended terminal units from the building structural system independent of the ceiling system. If this cannot be accomplished, provide additional intermediate angle iron from which the units shall be suspended. Level each unit.

B. Access to the terminal unit controls shall be accomplished by removal of ceiling panels or through an access door. Coordinate locations of access doors.

END OF SECTION

SECTION 233713 - REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Registers/Grilles/Diffusers: Submit product data including room schedule listing size, CFM, throw, direction of throw, accessories, finish, material type, color chart, pressure drop and noise criteria.

1.3 GENERAL REQUIREMENTS

A. Each manufacturer shall check noise level ratings for registers and diffusers to insure that the sizes selected will not produce noise to exceed N.C. - 24, measured at occupant level; notify Owner's Representative of problems prior to submittal.

B. Pressure drop, airflow and noise criteria selection is based on design equipment. Manufacturers not submitting design makes must provide written certification in front of submittal that equipment submitted has been checked against and performs equal to the design make.

C. Borders and frames shall be coordinated with materials and ceiling systems to integrate with architectural ceiling details and finishes scheduled.

D. Locations of ceiling mounted air terminal devices shall be coordinated with locations shown on architectural reflected ceiling plans.

E. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw and pressure drop. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

1.4 REQUIREMENTS FOR REGISTERS

A. General:

1. A register is defined as a grille plus a volume damper.

2. Registers shall be installed "sight-proof" where possible, i.e.: High wall register with horizontal blades inclined up, or along a wall with blades facing the wall.

3. Borders and frames shall be of the same material as register face unless specified otherwise.

B. Mounting Frames:

1. Provide with screw holes in register face punched and countersunk at factory, and mounting frame drilled and tapped to suit. Sponge rubber gasket between frame and wall or ceiling for all surface mounted frames.

2. Frame shall be overlap type and shall be suitable for type of ceiling where register is to be installed.

C. Finishes:

1. Baked enamel (of colors as selected from the manufacturer's standard color chart), as scheduled.

D. Design Equipment: Titus unless otherwise noted.

E. Manufacturers: Anemostat, Carnes, Krueger, Titus, Price, Tuttle and Bailey, Nailor.

1.5 REQUIREMENTS FOR DIFFUSERS

A. General:

1. Provide four way blow unless otherwise noted.

2. Where manufacturer's size recommendations require duct sizes or connections differing from design, Contractor shall provide at no change in contract price.

3. Suitable for recessed mounting unless otherwise indicated.

4. Provide square to round neck transitions as required.

5. Provide sponge rubber gasket for all surface mounted frames.

B. Finishes:

1. Baked enamel (of colors as selected from the manufacturer's standard color chart) as scheduled.

C. Frame style shall be suitable for ceiling type in which diffuser is to be installed.

D. Design Equipment: Titus unless otherwise noted.

E. Manufacturers: Anemostat, Carnes, Krueger, Titus, Price, Tuttle and Bailey, Nailor.

PART 2 - PRODUCTS

2.1 SUPPLY TYPES

A. Type 1 - (perforated face type, high volume low velocity):

1. Provided with one-way or two-way blow pattern as indicated on drawings.

2. Face or diffuser shall be constructed of 51 percent free area perforated steel with 3/16 inch diameter holes on 1/4 inch staggered centers.

3. The back pan shall be manufactured of 22 gauge steel.

4. The diffuser must be available for full radial air diffusion (two-way) and 1/2 radial air diffusion (one-way).

5. Panel Size = 24 in. x 24 in. OR 48 in. x 24 in. Refer to drawings.

6. Model: Titus Model TriTec.

B. Type 2 - (Smooth Face Type):

1. Steel construction with 22 gauge back pan and 22 gauge face panel with rolled edges that finishes flush with ceiling system.

2. Round neck - minimum 1-1/4 in. collar for duct connection.

3. Frame suitable for ceiling type.

4. With optional directional air flow pattern controllers that are concealed behind the face or in the neck.

5. Face panel shall be removed and securely held in place to the back pan without noise or vibration.

6. Horizontal airflow pattern.

7. Panel Size: 24 in. x 24 in. or 12 in. x 12 in., refer to plans.

8. Model: Titus OMNI.

C. Type 3 - (Supply Air Grille):

1. Steel 20 gauge frame construction with double deflection capability and the front blades shall be parallel to the long dimension. Solid extruded aluminum air foil blades mounted in friction pivots for individual blade adjustment, spaced on 3/4 in. centers.

2. 1-1/4 in. wide flange with sponge rubber gasket.

3. Model: Titus 272-RL.

2.2 RETURN/EXHAUST TYPES

A. Type A - (Exhaust and Return Grilles):

1. Steel construction with 22 gauge frame and blades, with horizontal bars on a 1/2 in. spacing set at 35° fixed deflection.

2. 1-1/4 in. wide flange.

3. The blades shall be parallel to long dimension.

4. Model: Titus 355-RL.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions. Rough in or install per reflected ceiling plan or in location instructed by Owner's Representative.

B. Provide approved air extractors behind all duct mounted supply registers in exposed ductwork.

C. When the final connection to an exhaust or return grille is made, a 12 in. minimum height plenum box must be supplied to all grilles. Plenum dimensions shall match grille size. Paint inside of plenum box flat black.

D. Seal all supply and return registers, grilles and diffusers during construction operations to limit dust entering HVAC systems and ductwork. Seals may be removed just prior to testing and balancing, but not without the approval of the Owner's Representative.

END OF SECTION

SECTION 233723.16 - LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS TO THE ARCHITECT/ENGINEER

A. Louvers including all blade types, finishes, and arrangements.

B. Provide original color charts for selection of finish.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Factory constructed high performance drainable, fixed, extruded aluminum 6 in. deep louvers.

B. Provide mullions where blade lengths exceed 60 in.

C. Sill extension and sill style as required by job conditions.

D. Louver to be flanged or un-flanged as required for the wall type in which it will be installed.

E. Heads, sills and jambs to be one piece structural members of 6063-T6 alloy with integral caulking slot and retaining beads.

F. Mullions shall be sliding interlock with internal drain(s).

G. Blades to be one piece extrusions with gutter(s) designed to catch and direct water to jamb and mullion drains.

H. Minimum extrusion thicknesses shall be as follows: Heads, Sills, jambs and mullions: 0.081". Fixed Blades: 0.068"

I. Closed cell PVC compression gaskets shall be provided between bottom of the mullion or jamb and the top of the sill to insure leak tight connections.

J. All fasteners to be aluminum or stainless steel.

K. All louvers to be furnished with 5/8 in. flattened expanded mesh, aluminum bird screen with a .055 in. thick extruded aluminum frame. Screens and screen frames to be standard mill finish.

L. All louvers shall be finished with powder coating of a custom color to be selected at the time of submittal review. Coating to be 1.5 to 3 mil. thick full strength 100% resin Fluoropolymer coating. Finish to adhere to a 4H Hardness rating. The louver manufacturer shall supply an industry standard 20-year limited warranty against failure or excessive fading of the Fluoropolymer powder coat finish.

M. Design Equipment: Ruskin ELF6375DX.

N. Makes: Construction Specialties, Inc., American Warming & Ventilating Inc., Arrow United Industries, Louvers & Dampers, Inc., Ruskin, Nailor, Greenheck.

PART 3 - EXECUTION

3.1 GENERAL

A. Install louvers as per manufacturer's recommendations.

3.2 LOUVERS

A. Size called for is approximate wall/or masonry opening size. Adjust slightly to suit construction or coursing (review architectural drawings or field conditions for rough opening sizes.) Louvers will be installed by General Contractor, assisted by this Contractor. Deliver in ample time**.** Slope ductwork, and plenum to louver weephole or provide drain.

B. Structural supports shall be designed and furnished by the louver manufacturer to carry a wind load in accordance with the 2020 Building Code of New York State.

END OF SECTION

SECTION 234100 - AIR FILTERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents. Install equipment in strict accordance with manufacturer's instructions, and as detailed on the Contract Documents.

1.2 SUBMITTALS

A. Filter product data including certification date, pressure drops at the scheduled airflow, schedule of filter sizes for each system. All filter accessories, including framing systems, fastening clips, manometers, and differential pressure gauges.

B. Provide product test reports for each listed efficiency including all details as prescribed in ASHRAE Standards 52.1 and 52.2 including testing per Appendix J.

1.3 QUALITY ASSURANCE

A. Filters shall comply with the requirements of ASHRAE Standard 52-76, and UL Standard 586-Class II requirements. Filters shall also comply with requirements of applicable State and federal agencies. Filters shall not exceed a flame spread rating of 25 and smoke development rating of 50.

B. Manufacturer shall provide evidence of facility certification to ISO 9001: 2008.

1.4 CERTIFICATION

A. Submit with submittal, a test report prepared by an independent testing laboratory certifying compliance with above standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MAKES

A. Freudeberg Filter Division/Viledon, Tri-Dim, Filtration Group, Camfil-Farr

2.2 MEDIUM EFFICIENCY AIR FILTERS (MERV 8 PLEATED TYPE)

A. The filter shall have a Minimum Efficiency Reporting Value of MERV 8 and a minimum arrestance of 95%A when evaluated under the guidelines of ASHRAE Standard 52.2-2007. It shall also have a MERV A of X-A when tested per Appendix J of the same standard. The media shall maintain or increase in efficiency over the life of the filter. The filter shall be classified by Underwriters Laboratories as UL Class 2.

B. Filter media shall be a polyester/cotton blend or 100% synthetic blend, mechanical media which does not support microbial growth, lofted to a uniform depth of 0.18 in., and formed into a uniform radial pleats. There shall be at least 15 pleats per linear foot for the 2 in. deep filter. A welded wire grid, spot-welded on one-inch centers, treated for corrosion resistance, shall be bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation.

C. Frame shall be heavy duty, high strength, moisture resistant paperboard with a cross member design that increases filter rigidity and prevents breaching. Frame shall be made with 100% recycled paperboard with an average of 35% post-consumer content. Frame shall be recyclable.

D. The enclosing frame, of no less than 28 point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media to prevent air bypass, and include integral diagonal support members on the air entering and air existing side to maintain uniform pleat spacing in varying airflows.

E. For the 2 in. filter, initial resistance to airflow shall not exceed 0.31 in. w.g. at an airflow of 500 fpm.

F. Filter shall have a recommended maximum final resistance of 1.0" w.g.

G. Filter Thickness: As indicated in schedule.

H. Design Make: Camfil-Farr 30/30.

2.3 EXTENDED SURFACE RIGID CASSETTE FILTER

A. The filter media shall be 100% synthetic and manufactured from three distinct layers. The prefilter layer shall be a spun bond polyester. The middle layer shall be constructed from electrostatically spun polycarbonate microfibers. The downstream layer shall be a spunbond. Filters containing either urea-extended phenol formaldehyde binders, wet-laid microfiberglass, or polypropylene microfibers are not acceptable.

B. The filter media shall be resistant to mechanical damage caused by handling.

C. The filter media packs shall be sealed to plastic end caps with hot glue to ensure leak-proof seal.

D. Frame shall be high-impact plastic and contain no metal parts.

E. The filter media shall be hydrophobic and the filter shall operate unaffected at relative humidity up to 100%.

F. Filter shall incorporate 1" offset to improve air intake performance. Filter shall be available in 12.5" depth.

G. The filter shall be UL classified as to flammability, Class 2.

H. The filter shall have a Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of ASHRAE Standard 52.2-2007. It shall also have a MERV A of 13-A when tested per Appendix J of the same standard. The media shall maintain or increase in efficiency over the life of the filter. The filter shall be classified by Underwriters Laboratories as UL Class 2.

I. Initial resistance to airflow shall not exceed 0.22" w.g at an airflow of 500 fpm. Filter shall have a recommended maximum final resistance of 1.5" w.g.

J. Filter shall have a documented wet burst strength of no less than 15" w.g.

K. Design Make: Viledon MV-series.

2.4 MAGNEHELIC GAUGE

A. 3-7/8 in. diameter white dial diaphragm actuated air filter gauge. Guaranteed accurate to ± 2% of full scale. Pointer zero adjustment. Provide all accessories including adapters, mounting panel, pressure tips, fittings, tubing, and vent valves.

B. Range:

1. Pre-filters; 0-1" wc, Dwyer Model 2001

2. Final filters; 0-2" wc, Dwyer Model 2002

C. Design Equipment: Dwyer Magnehelic Series 2000 with air filter gage accessory package.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide one set of spare filters of each type for each system requiring a filter. Install first set of filters when units are initially installed (as opposed to started). Change filters as required during construction period to maintain systems in a clean manner throughout the construction period. Remove dirty set and install one clean set prior to Owner occupancy. If original filters do not required replacement, as determined by Owner's Representative, then deliver final set to Owner and obtain receipt.

B. Provide proper safing around filter bank and caulk airtight.

C. Install filter frames as per manufacturer’s recommendations. Provide vertical stiffening bars sized and spaced per the manufacturer.

3.2 MAGNEHELIC GAUGES

A. Provide for each filter set.

END OF SECTION

SECTION 235700 - HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plate and frame heat exchangers.

1.2 DEFINITIONS

A. TEMA: Tubular Exchanger Manufacturers Association.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which heat exchangers will be attached.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:

1. Structural failures including heat exchanger, storage tank, and supports.

2. Deterioration of metals, metal finishes, and other materials beyond normal use.

C. Warranty Periods: From Date of Substantial Completion.

1. Plate, Domestic-Water Heat Exchangers:

a. Plate-and-Frame Type: One (1) year.

PART 2 - PRODUCTS

2.1 PLATE AND FRAME HEAT EXCHANGERS

A. Acceptable Manufacturers:

1. Basis of Design Product; Subject to compliance with these requirements to provide. Bell & Gossett heat exchanger(s) or compatible product as manufactured by:

   a. Sondex
   b. Alfa-Laval
   c. Armstrong

B. Provide plate and frame heat exchanger with individually removable 0.5 mm, 316 stainless steel plates with epoxy coated steel frame aluminum OSHA shroud, nitrile "presstite" glueless gaskets, nylon roller assembly.

1. General:

   a. Unit shall be single pass unless otherwise specified.

   b. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one piece gaskets.

   c. Construction: Fabricate and label heat exchangers to comply with ASME Boiler Pressure Vessel Code, Section VIII, "Pressure Vessels", Division 01. Minimum pressure rating of 150 psig.

   d. For single pass units, all connections shall be located on the fixed head, frame plate allowing the movable head, pressure late, to slide back and plates added, removed, or replaced from the plate pack without disturbing.

   e. The design shall allow for the removal of interior plates without the removal of the preceding plates.

   f. Unit(s) within the scope of AHRI Standard 400 shall be certified and list the manufacturer's AHRI part number for liquid to liquid heat exchanger. Unit(s) outside the scope of AHRI Standard 400 shall be designed according to the standard and list the manufacturer's AHRI part number, surface area, and corresponding heat transfer coefficient.

2. Frame:

   a. The frame plate and pressure plate shall be carbon steel SA 516 Grade 70.

b. The frame and pressure plate shall be of sufficient thickness to meet the ASME design pressure. Stiffeners to support brackets are not acceptable.

c. Carbon steel frame components shall be painted with epoxy paint.

d. Units with 3 in. or greater connections shall be unlined or alloy lined studded ports to mate with raised face or flat faced ANSI flanges. Rubber liners are not acceptable.

e. Units with 2 in. or 2-1/2 in. connections shall have carbon steel female tapped NPT or male NPT connections if an alloy material is required.

f. Units with 1 in. ports shall have carbon steel or 316 stainless steel female tapped NPT or male NPT connections if an alloy material is required.

g. Units with connections greater than 2 in. require that the thermal plates be supported by the carry bar, top bar. The guide bar, bottom bar, shall only help properly align the plates.

h. The carry and guide bar plate contact surfaces shall be stainless steel.

i. Units with 2 in. connections or smaller shall allow the plates to be supported by the guide bar, bottom bar and the carry bar, top bar, to properly align the plates. Carry and guide bars shall be steel with a zinc chromate coating.

j. Provide a protective shroud to cover the exposed top and sides of the plate pack. The shroud shall include handles to provide quicker and safer removal during maintenance. The shroud shall be aluminum or stainless steel as required.

3. Tightening Bolts:

a. Tightening bolts shall be zinc plated carbon steel SA193 B7.

b. The tightening bolt assemblies shall include captive working nuts at the pressure plate, rear head, such that the unit can be opened and closed with one wrench from the front of the unit.

c. Thrust bushings (ball bearing box washers) shall be located at all critical closing bolts on plate heat exchangers with 10 in. connections or greater. The thrust bushings shall allow for easy opening and closing of the plate heat exchanger without damaging the epoxy coating of the follower (fixed pressure plate).

4. Plates:

a. Plates shall be pressed in a one step stamping process.

b. Plates shall use an integral rolled edge handing system to provide a rigid hanger device between the plate and carry bar and guide bar. Welded on hanging brackets or stiffeners are not acceptable.

c. The plate pack shall use a positive plate to plate alignment system to ensure proper plate to gasket seals throughout the plate pack. The positive alignment system shall either be a gasket lug which fits within a plate recess on the proceeding plate (tongue in groove) to align successive plates or an extended rolled edge hanger which nests successive plates through direct contact around the entire plate hanger. Plate designs, which only offer alignment through contact with the carry and guide bar, are unacceptable.

d. Plates shall be permanently marked to indicate plate materials and thickness.

5. Gaskets:

a. All gaskets except the gasket on the first plate shall be identical.

b. The gaskets shall be a one-piece construction with a double gasket barrier at the port region. The area isolated by the double gasket shall be vented to the atmosphere, so that a gasket failure is detected by leakage to the exterior prior to any possible cross contamination. Gaskets shall include color coded tabs that protrude past the perimeter of the heat transfer plate in order to allow positive identification of the gasket material without opening the heat exchanger.

c. When available, glue free gaskets are preferred to glued-on gaskets. Gasket attachment methods, which break during gasket removal or plate maintenance, thus destroying the gasket is not acceptable.

C. Unit shall be ASME 'U' rated to 150 psi at 284°F.

D. Unit shall be UL listed.

E. Heat transfer performance as listed in schedule.

F. Heat exchanger shall be constructed as required by ASME and shall permanently display and ASME 'U' stamp.

2.2 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel supports for mounting on floor.

2. Factory fabricated steel supports to ensure both horizontal and vertical support of heat exchanger.

3. Integral mounting bracket.

B. Heat Exchanger Insulated Shroud:

1. Provide OSHA compliant modular insulation package consisting of inner and outer panel covering all sides, top and bottom including frame and pressure plate.

2. Shroud shall be constructed of an inner aluminum liner, 2 in. thick polyisocyanurate foam board insulation and an outer embossed aluminum panel.

3. Insulation panels shall site in a 24 gauge galvanized steel drip tray with valved drain line.

4. Modular design shall incorporate stainless steel spring tension loop above latches that provide a tight seal for rubber type compressed between the latches.

5. Insulation shroud shall be removable and reversible.

6. Service temperatures shall be -100°F to 250°F.

7. Panel insulation shall meet flammability ratings under ASTM E84, E119 and UL 723, 1040 and 1715.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GASKETED-PLATE HEAT-EXCHANGER INSTALLATION

A. Equipment Mounting: Install heat exchangers on cast-in-place concrete equipment base(s).

1. Constructed bases to withstand, without damage to equipment, seismic force required by code.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 in. centers around the full perimeter of concrete base.

3. For supported equipment, install epoxy coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3.3 CONNECTIONS

A. Maintain manufacturer's recommended clearances for tube removal, service and maintenance.

B. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

3.4 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION

SECTION 237513 - AIR HANDLING UNITS – CUSTOM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, miscellaneous materials, and services to perform all operations required for the complete unit assembly as shown on the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 233400 – Fans

B. Section 234100 - Air Filters and Accessories

1.3 SUBMITTALS

A. Submit shop drawings on air handling units. Submittal shall include all dimensional drawings with associated weights and breakdown details pertaining to shipping and rigging. Include all materials of construction as well as fabrication and connection details.

B. Shop drawing to include plans and elevation detailing exact location of all components, access door locations with indicated swing direction, duct and piping connection sizes, shipping split locations and maintenance access clearance dimensions.

C. Provide information on all coordinated conduit routing and sizing as it pertains to coordination with electrical and control system.

D. Provide detailed performance of all components for comparison to all scheduled values including but not limited to following: Fan manufacturer and performance curves with operating points clearly indicated. All motor size and type information. Coil selections with sizing, rows, fin spacing, face velocity, air and fluid temperatures, flow rates, pressure drops and connection sizes. heat recovery components with performance characteristics. Filter type, sizing, efficiency and pressure drop.

E. Provide complete electrical data information including wiring diagrams and accessories. Clearly indicate differentiation between factory and field wiring.

F. Provide octave band sound power levels for intake, supply and return air connections as well as radiated sound levels from enclosure.

G. Provide all factory testing data with associated testing procedures.

H. Test results showing AHU foam casing panel construction is in compliance with NFPA 90A & 90B via Certified ASTM E84 report showing it is within maximum flame spread index and smoke developed index "or" provide documentation the equipment is ETL tested and listed in accordance with ANSI/UL 1995, the standard for safety for heating and cooling equipment.

I. Operation and maintenance manuals. Include list of all required service procedures and intervals. Include list of required replacement parts for maintenance.

1.4 MANUFACTURER AND EQUIPMENT SUPPLIER AND GENERAL BIDDING REQUIREMENTS

A. It is the intent of these specifications and referenced specification sections to provide the minimum design and performance parameters without being proprietary toward a specific equipment supplier. It is the responsibility of the listed acceptable equipment suppliers to meet the basic intent of the specifications and drawings. The overall "box" size of Air Handling Units as shown on Drawings shall not be deviated from. It is not the option of the equipment supplier to increase or decrease the physical size of the equipment without engineer approval. In addition, the configuration or layout of the individual components within the unit cannot be modified or changed without qualified explanation and approval of engineer. Any deviations shall be clearly identified on submittal. Final dimensioning of unit casing and openings shall be part of coordination drawing process performed by contractor prior to ordering of equipment

B. Delivery, Storage and Handling:

1. Air Handling Units shall be shipped to the site in assembled sections based on shipping splits suitable for rigging at the site. Size of each piece shall be no greater than required for trucking or rigging (Refer to plans for more detail). The equipment supplier shall provide Factory Personnel to assist in assembly of the unit at the site. AHU manufacturer to provide onsite assembly crew supervisor to meet indicated construction schedules.

2. When scheduling does not allow delivery directly to the job site for unforeseen complications then an indoor weather tight secure storage facility must be utilized and is not considered as delivery. All unit openings and components must remain sealed to prevent any entrance of dust or dirt.

3. The units must be rigged and lifted in strict accordance with the manufacturer's recommendations.

C. Manufacturer shall refer to associated custom air handling unit drawings for additional details and requirements.

D. Unit shall be site built.

E. Maximum total unit weight as shown on custom air handling unit drawing is limited to 50 lbs/sqft.

F. Pressure drop across each filter bank shall be minimum 1.5 in. w.g. and shall be included into the internal static pressure losses of the equipment.

G. Design Equipment: Air Enterprise

H. Acceptable Makes: Air Enterprise, Buffalo Air Handling, Ingenia, York.

1.5 PERFORMANCE TESTING

A. The equipment supplier shall include in their bid price, the cost associated with hiring a certified Testing and Balancing Contractor to test and document all performance parameters of the air handling unit at the time of start up after all penetrations are in place. The unit design cfm and static pressure shall be delivered as a brake horsepower within 2% of design conditions. Multiple point temperature readings shall be taken down stream of the mixing section to certify that temperatures do not vary by more than 10°F across the face of the preheat coil.

B. In addition, the Testing and Balancing Contractor shall perform an air handling unit casing leakage test and provide documentation. Sections of the air handling unit that will normally operate under positive pressure shall be tested under positive pressure. Sections of the air handling unit and exhaust air unit that will normally operate under negative pressure shall be tested under negative pressure. At 10 in W.G. pressure, the maximum leakage allowance shall be as per the following table:

UNIT CFM	MAXIMUM ALLOWABLE LEAKAGE
Less Than 10,000	0.5%
10,000 – 30,000	0.5%
Greater than 30,000	0.5%

C. The Testing and Balancing Contractor shall submit the documented test results directly to the Engineer. The report format and the parameters to be tested shall be as per the requirements of Specification Section 230593 – Testing, Adjusting and Balancing. This requirement for performance testing is in addition to the adjusting and balancing requirements associated with the HVAC Contract.

D. A casing leakage test shall be performed in the field after unit is fully assembled in place.

1. The testing shall be witnessed by representatives from Cornell University, the Commissioning Agent and the Engineer of Record.

2. The casing leakage test shall verify the unit casing leakage is less than specified percentage of the full design airflow when tested at 1-1/2 times the design maximum static pressure. The unit shall be sealed with blank off plates over all duct connections, all coil header penetrations to have sealing grommets installed and all conduit and controls openings shall be sealed. Positive pressure sections shall be put under positive pressure. Negative sections shall be put under negative pressure. The leakage shall be measured in each section using a calibrated orifice plate. The total casing leakage (positive plus negative) shall be considered the total sum of the positive and negative leakage not to exceed the 0.5% limit.

3. In the event that the actual performance of the air handling unit does not fall within the acceptable window, the unit manufacturer shall make all necessary corrections without additional cost to the Owner, and also reimburse the Owner for the cost of any additional testing needed to document performance. The corrections shall be long term permanent solutions in line with unit construction details and not inhibit the normal use of access doors and service panels.

4. In the event the manufacturer cannot achieve the submitted performance parameters and leakage, the Owner reserves the right to seek an adjustment from the manufacturer commensurate with the Owner's anticipated increased operating costs.

E. The units shall be constructed for indoor installation. The unit construction shall be factory designed, fabricated/built, and assembled. The unit manufacturer shall be completely responsible for the unit assembly as well as arranging/performing the onsite verification testing specified.

1.6 FACTORY AUTHORIZED START-UP AND FACTORY JOINING SERVICE

A. The AHU Manufacturer shall provide **[56]** hours of factory start-up and joining service.

1.7 TRAINING

A. The AHU Manufacturer shall provide 2 hours of training.

1.8 WARRANTY

A. Except as otherwise specified, the Contractor shall warrant and guarantee all work against defects in materials, equipment, and workmanship for a period of one (1) year from the date of acceptance of the work as evidenced by a resolution to that effect by the Owner and for that period of time noted in special or extended warranties.

B. Unit casing and structural base shall be warranted against corrosion or failure under normal operating conditions.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide air handling units to fit intended use and in locations called for. Capacity, size arrangement, static pressure, brake horsepower, component parts and accessories as called for and as necessary to obtain required results and allow for proper maintenance. Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. Guaranteed sound power level ratings not exceeding those of design equipment, or as scheduled.

B. All equipment shall be statically and dynamically balanced to acceptable tolerances with weights permanently fastened to fan blades, and components including the motor, installed on unit.

C. Classification as designated by Unit Manufacturer or minimum requirement list below:

Total S.P.	Class
Up to 3 3/4 in. WG-STD	I
Up to 6-3/4 in. WG-STD	II
Up to 12-3/4 in. WG-STD	III

D. Airflow inlet and outlet opening limited to a maximum velocity of 1500 fpm unless specifically noted otherwise on design detail drawing.

E. Vibration levels shall be factory tested and field verified. Special balancing and structural components shall be provided to minimize harmonic vibrations.

F. More than one manufacturer is listed as Make. Contractor must be certain that equipment submitted fits properly into indicated space conditions the same as the Design Equipment.

G. Fans:

1. Fans shall be AMCA 210 certified for performance and rated in accordance with AMCA 300 for sound.

H. Unit to be completely pre-wired and pre-piped per drawing and specifications.

I. Each AHU shipping section to incorporate an exterior 4x4 junction box with sealed conduit into airstream section to allow control subcontractor into air handling unit without any field drilling through panel system in the field to compromise panel leakage integrity.

2.2 AIR HANDLING UNITS

A. General:

1. Provide fan sections, filter sections, mixing box, plenums, coil sections, heat recovery components, damper configurations and other sections as called for and shown on the Contract Drawings. Maintain Draw-thru configuration as indicated in plans.

2. Gauges of metal and construction to be heavy enough to prevent vibration, undue noise or breathing. Unit design based on all aluminum construction.

3. Each coil shall be independently supported so that any one coil can be removed without removing another coil. Coil racks to be stainless steel.

B. Fan Sections:

1. Motors: Furnished by equipment manufacturer. See Specification Section 230513 - Motors. Horsepower and type as called for from acceptable manufacturers listed. When VAV drives are used, the motors provided shall be matched to the variable speed drive selected for use.

Motor to be suitable for use as direct drive application and be matched to fan to meet performance requirements. Provide with shaft grounding system.

2. Drives:

   a. Equipment supplier shall provide all direct drive fans. Belt driven fans are not acceptable.

3. Plenum Type:

   a. All fans shall be constructed to AMCA Standards and capacity shall be AMCA Standards 210-74 certified for performance and rated in accordance with AMCA 300 for sound. Fan shaft shall be solid 1040 or 1045 hot rolled steel that is turned, ground and polished.

   b. The blades shall be aluminum airfoil design and shall be continuously welded to the wheel shroud and backplate. The fan shall be mounted in the horizontal position and shall be an Arrangement 4.

   c. The frame shall be constructed of heavy structural steel members, continuously welded.

   d. Provide guards meeting OSHA standards at fan inlet and to completely enclose fan wheel and rotating parts. Provide flexible connection between fan inlet and inlet wall. Provide dampened thrust restraints.

   e. Fans shall be designed for low vibration and within limits of ANSI/AMCA 204 Fan Application Category BV-3. Fans shall have a full spectrum dynamic balance for fan class. Field testing, and submittal shall include a full vibration report including a summary of bonded spectrum limits, spectrum plots on 3 axis, a waterfall (cascade) plot, a time waveform plot and a transient capture (coast down) plot. Vibration target level to be 0.12 in/sec or better to achieve satisfactory range vibration per ISO 10816.

   f. Provide overhead beam with trolley for removal of fan motor(s) over 15 hp. Align with motor and access panel/door. Arrangement to allow for removal of fan motor and components through casing into mechanical room.

   g. Provide all fans with Piezometer rings or Vortex shedding airflow stations installed in fan inlet.

   h. Provide mean to facilitate (lift points, etc.) fan motor removal/replacement which do not interfere with airflow.

4. Vibration Isolation:

   a. Provide vibration isolation equipment for each fan supplied inside the air handling unit enclosures.

b. Fan and Motor mounted on a vibration isolated steel frame which is itself then supported on a steel inertia base. Spring type isolators shall be between the inertia base and air handling unit enclosure.

c. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall not be less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 60% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately1 (one). All mounts shall have leveling bolts. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of neoprene. Each isolator shall be mounted on a 1/4 inch thick neoprene friction pad. A rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. Grommets shall be provided for each bolt hole in the bearing plate. Minimum static deflection shall be 2.0 in.

d. Plenum fans shall be provided with spring thrust restraints.

e. Flexible connector: woven nylon/polyester blend with vinyl coating. Minimum fabric weight - 22 oz./sq. yd.

f. Make: Mason Industries, Inc., Vibration Mountings and Controls, Inc., Kinetics Noise Controls, Inc.

5. Fan Make: Twin City, Greenheck, Aerovent.

C. Hot Water / Glycol Heating Coil Sections:

1. Hot water heating coils, serpentine type, number rows and arrangement as scheduled or as required to meet performance specifications, non-ferrous headers and connections, same end connections with vent chamber on return end and completely drainable. Coils shall be designed for 125 psi working pressure, and shall be designed to relieve expansion and contractions strains.

2. Coils shall be selected with a maximum face velocity of 550 FPM.

3. Vent and drain connections shall be provided at the top of bottom of each header and shall be no less than 1/2 inch NPT.

4. 5/8 in. O.D. copper tubes not less than .035 in. wall thickness with .035 in. thick "U" bends and .0075 in. thick aluminum fins. Fin spacing shall not exceed 10 FPI. All tubes shall be seamless construction with 304 stainless steel casings; grooved connections NOT acceptable.

5. Head pressure loss through coil shall not exceed that scheduled in the documents.

6. Coils to be individually supported by a stainless rack system. The rack shall allow any one (1) coil to be removed through the unit casing without disturbing any other coil.

7. Removable panels shall be located on both sides of the air handler unit, not just on the coil removal side.

8. Manufacturers: Heatcraft or Aerofin

D. Chilled Water Cooling Coil Section:

1. Chilled water coils, serpentine type, number rows and arrangement as scheduled or as required to meet performance specifications, non-ferrous headers and connections, same end connections with vent chamber on return end and completely drainable.

2. Coils shall be selected with a maximum face velocity of 450 fpm and minimum 20°F temperature rise. Unit manufacturer shall assure no moisture carryover from coils at design conditions.

3. Head pressure loss through coil shall not exceed that schedule in the documents.

4. 5/8 in. O.D. copper tubes not less than .035 in. wall thickness with .035 in. thick "U" bends and .0075 in. thick aluminum fins. Fin Spacing shall not exceed 10 FPI. All tubes shall be seamless construction with 304 stainless steel coil casing; grooved connections NOT acceptable.

5. Coils to be individually supported by a stainless steel rack system. The rack shall allow any one (1) coil to be removed through the unit casing without disturbing any other coil.

6. Units to be provided with removable panel to allow for coil removal. These panels shall be gasketed, effectively sealed without other sealants or caulks, and shall be secured with stainless steel machine screws or other reusable fasters. Self-tapping screws are not acceptable.

7. Positively pitched type 304 stainless steel drip pan(s), minimum of 18 gauge, shall extend continuously under each coil with a minimum 3 in. overhang upstream and 12 in. of overhang downstream. Each pan shall have its condensate piped to common exterior connection. Each coil shall be caulked and flashed in place to prevent carryover of condensate.

8. Active cooling coil condensate drain connections to be a minimum 12 inches above the bottom of the air handling unit base for trapping.

9. Removable panels shall be located on both sides of the air handler unit, not just on the coil removal side.

10. Manufacturers: Heatcraft or Aerofin.

E. Air Handling Unit Casing:

1. Double wall, insulated, air pressure tight, casing assemblies. Aluminum panels with aluminum framing members. All parts shall be aluminum, unless otherwise indicated elsewhere in this specification. Where dissimilar metals are used they shall be dielectrically isolated to prevent galvanic action. No through metal shall be allowed and shall be achieved with a minimum 3/8" thick epoxy bridge between metals. Adhesive tapes or gaskets will not constitute an acceptable thermal brake. Bolts and hardware shall be stainless steel.

2. Design Panels minimum 2-1/2 in. thick with minimum .050 (16 gauge) textured/embossed solid exterior sheet and .05 in. (16 gauge) solid inside sheet. All sections to have solid interior liner, smooth mill finish, unless specifically noted otherwise. Provide perforated interior sheets on discharge plenum and fan sections. Roof panels with minimum 0.63 in. (14 gauge) exterior sheet. Wall panels shall be continuously sealed (gasketed) between interior and exterior skin. Spot welding or mechanical fasteners shall be on 6 in centers maximum. The maximum allowable panel deflection is $1/200^{th}$ of the panel span at 1-1/2 times the unit design static pressure. Thermal brake and panel insulating coefficient shall be designed to guarantee that casing will not sweat with exterior casing conditions of 91 DB-74 WB and interior conditions of 53F.

3. Interior panel space packed with blown foam, 3.0 PCF. Panel U-value shall not exceed 0.0588 BTU/hr./sq.ft/°F (R-12 minimum) based on 2-1/2" minimum panel thickness. UL fire rating; flame spread - 10-20, fuel contributed - 1015, smoke developed - 0-20. Foam board or fiberglass insulation is not acceptable. The structural panel system shall be built to meet the requirements of NFPA 90A and 90B for fire and smoke spread. Air Handling Unit (AHU) Manufacturer to provide proof of compliance to NFPA 90A & 90B. If the air handling unit is to be field erected, the AHU manufacturer shall provide a third party ETL listing once assembled onsite. AHU manufacturer to pay all associated costs for third party onsite listing.

4. Access doors for serviced access between each section and as shown on Contract Drawings. Door swing to be based on pressure differential direction of flow so that doors are pushed closed and not open when unlatched under operating pressures.

5. Base rails: Units to have aluminum channel base rail of sufficient depth for proper unit support and condensate trap, minimum 6 in. Unit floor in air handling sections shall be 3/16" minimum thickness aluminum checker plate with continuous 2 inch raised lip at perimeter of unit and between sections and fully welded watertight (spot welding or threaded fasteners sealed watertight is not acceptable). Provide individual drains in each section of the air handling unit with piping extended to unit exterior base and (capped) for piping trap connections in the field. All section or compartments of the unit shall be fully drainable. The floor plate thickness and supports shall be sufficient to avoid any "tin canning" when 200 lb. point loading is applied to the flooring system and a minimum of 100 lb. per square foot throughout the unit.

Floor pan shall be foam insulated 2 in. thick (indoor unit) to prevent condensation and sealed with exterior 0.040" aluminum skin. Skin to be recessed inside of unit base to prevent rigging damage. Skins fastened to bottom of unit support rails are not acceptable.

6. The unit base shall be provided with sumps in outside air sections or as indicated in the documents. Sumps shall be welded and guaranteed watertight to serve as a drain pan to prevent water damage from the unit.

7. All equipment within the air handling unit shall be provided with a minimum 2" high base rail to raise the equipment off the unit floor for housekeeping. Equipment mounted directly to the floor with fastener or drilled holes penetrating the water seal of the base is unacceptable.

8. Door panels constructed of same material and gauges as panels; minimum door size of 24 in., unless otherwise indicated on drawings, 2-1/2 in. minimum thickness of the overlapping seal type. Doors shall be supplied with continuous non-pitching gaskets. Doors to be supplied with stainless steel piano hinges. Minimum of two cast aluminum or fiber reinforced plastic door latches with an inside release handle. Doors shall be assembled with hinge hardware attached and adjusted in the field. The door gaskets shall incorporate two continuous separate gasket seals around the periphery of the door. Gasket materials shall be UV resistant, closed cell neoprene: gaskets shall be attached by adhesive and not mechanically held in place Door latches wedge lever type with handles inside and outside. Hinges designed for door size and weight. Doors installed to open against the air pressure. Interior doors shall have 10 in. (min.) square thermal pane windows. A door entering into rotating components of the air handling unit shall be provided with signage indicating "Do Not Enter – Rotating Machinery". Provide 1" diameter test ports with screwed caps on casing upstream and downstream of filters and coils for pressure and temperature measurement.

9. Roof channels, aprons and corners joined of aluminum and formed to prevent a direct path for sound and/or air leakage. Panel joiners 20 gauge minimum. Where these roll formed joiner sections are not utilized, 16 gauge minimum. Panel joiners and connectors shall allow for expansion.

10. Air and watertight sleeves, caulked and insulated where pipes and conduits penetrate unit casings.

11. Provide framed openings with curved bell mouthed fittings for duct connections with exit velocities exceeding 2000fpm. Bellmouth fittings shall have a minimum smooth radius equal to 20% of the diameter (round or oval) or shortest side (rectangular) to provide optimum performance. Bellmouths to be mounted flush with the interior edge to minimize exit loss. Where openings are in floor, provide a removable safety grating fastened to opening framing. Supply opening safety grating to be aluminum. All floor openings shall have a 3 in. high frame welded to the pan to prevent water from entering the building.

12. The structure shall be fully self-supporting. Where roof spans and wall loadings require additional structural strength, it shall be furnished either by heavier roof and wall joiners, or, additional structural members capable of withstanding a differential pressure of 10 in. w.g. Unit built on unpainted aluminum base channel. The unit base shall be insulated with 2 in. of 3 lb./cu. in. density insulation with an aluminum liner for additional sound attenuation.

13. Provide plug panels for removal of fans, motors, heat recovery components and coils. Split panels where removal of a single coil is through connection side.

14. Any equipment flashing, internal partitions or other attachments to the casing shall be made in such a way as to ensure a permanent leak tight connection. Attachments that are bolted, screwed, or welded to or through the casing creating air bypass, air leakage or rust propagation area are not acceptable.

15. Multiple section units shall be bolted together in the field using 304 stainless steel bolts, nuts and washers.

F. Energy Recovery Coils:

1. Energy recovery coil to exchange heat/cooling between two air streams for heat and cooling recovery. The HRC shall be inside and integral to the equipment cabinet.

2. Air-to-Air Energy Recovery Heat Pipes to exchange heat/cooling between two air streams for heat or cooling recovery. The heat pipes shall be inside and integral to the equipment cabinet or located in the ductwork. In either case, drain pans are required and to be provided by others. Heat Pipe circuits comprise multiple tubes connected in series, end-to-end. The heat pipe circuits shall be: level to attain equal amounts of heat and cooling recovery.

3. Energy recovery heat pipes shall be tested and certified to AHRI standard 1060. Performance printouts as well as the product itself to carry AHRI 1060 compliance logo. Documents showing testing in accordance with AHRI 1060, but not certified by AHRI, will not be acceptable. Tests shall also show zero EATR (Exhaust Air Transfer Ratio) from exhaust to supply air.
Any deviation from the specifications must be approved by the engineer no less than ten days prior to the project bid date. Heat pipes shall be completely manufactured and fully assembled at the manufacturer’s facility by factory personnel. Conversion of third-party coils is not acceptable.

4. The Heat Pipe supplier shall have a minimum of 5 years of experience designing and installing Heat Pipes specifically for energy recovery applications.

5. The tubes shall be 1/2” OD copper, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.

6. The fin surface shall be continuous plate type, aluminum, copper fins of specific design to produce maximum heat transfer efficiency for Heat Pipe applications. Airside pressure loss shall be as given on the schedule, or otherwise specified. Fin density and the number of rows of tubes shall be as specified.

7. The Exhaust Heat Pipe modules shall have an optional protective coating of, E-Coat, similar to Electrofin. Coils shall be dipped and completely submerged to ensure full coverage of coating - spray coatings are not acceptable.

8. Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2013.

9. Heat Pipe capacities, entering and leaving dry and wet bulb temperatures, and face velocity shall be as specified.

10. The frames and mounting structure shall be minimum 16ga stainless steel. The supply and exhaust air streams shall be isolated from each other by, a foam-filled double separating partition. Cross-contamination between the air streams is not acceptable.

11. Each Heat pipe circuit shall be individually processed, charged, and hermetically sealed.

12. Scheduled effectiveness or heat recovery shall be met at a minimum and total pressure drop shall not be exceeded. The resulting Recovery Efficiency Ratio, or RER, shall therefore, be met at a minimum.

13. The Heat Pipes shall be ETL, or UL listed to UL standard 207 and CSA standard C22.2.140.3

14. The Heat Pipe heat exchanger shall have a five (5) year limited warranty. The heat pipe exchanger warranty shall include the refrigerant charge. All components such as valves and dampers shall carry a 12-month warranty.

G. Filter Sections:

1. Refer to Specification Section 234100 for further requirements.

2. Provide one extra full set of all final filters and pre filters.

3. Provide access doors for replacing filters and access to dampers.

4. Provide a filter magnehelic gauge for each filterbank. Gauge to be 3-7/8 in. diameter white dial diaphragm actuated. Guaranteed accurate to + 2% of full scale. Pointer zero adjustment. Provide all accessories including adapters, mounting panel, pressure tips, fittings, tubing, vent valves.

5. Filter racks to include internal vertical stiffeners.

H. Accessories: As called for.

1. Provide outside air plenum and discharge plenum section with outlets as shown on the Contract Drawings.

2. Provide floor drains in outside air plenum, access ahead of filter section and coil sections.

3. Unit shall be prewired for lighting and receptacles. Pre-wiring shall include but not limited to:

   a. Single point connections - interior lighting. Each connection point shall have conduit through the side of the unit for extension by others.

      1) Lighting connection shall be suitable for 120V single phase, 20A. Unit power requirements shall not exceed the scheduled and as indicated herein.

   b. Receptacles: Provide a minimum of two 120 volt duplex receptacles on the exterior. All receptacles shall be ground fault interrupting type and have a weatherproof cast aluminum cover.

   c. All electrical work and entire installation shall be in accordance with the NEC and Division 26 of these specifications. Provide thermal and moisture barrier in all conduits penetrating to air handling areas.

4. Provide internal Water-tight marine lights with LED lamps and wire guards within each section of the unit that has an access door. This lighting shall provide a minimum of 40 foot candles throughout. All the lighting within the unit shall be controlled by a single centrally located electronic timer switch equal to Woods Model #59013.

5. All fans shall be wired to a 4x4 junction box mounted to enclosure exterior. Installation of wiring and conduit shall be in conformance with NEC. Field wiring from junction box to adjustable speed drive by contractor.

6. Provide a minimum of four (4) 3/4 inch diameter pipe penetrations, air tight, with threaded connections through the exterior and interior of unit for field use by the Installation Contractor. The pipe penetrations shall be spaced evenly along the length of the unit and shall be located on the same side as the access doors. The pipe penetrations shall be located 1'-0" down from the top of the air handling unit enclosure. Coordinate with Controls Contractor.

7. Motor removal rails for all fan sections.

8. Dampers:

   a. Return, Exhaust and Outside Air Dampers:

      1) Dampers shall be opposed blade, unless otherwise noted on drawings, aluminum, airfoil, and low leakage type design. Leakage Class 1A at 1 in. w.g.

      2) Blade and frame seals shall be of extruded silicone. Seals are to be secured in an integral slot with the aluminum extrusions.

      3) Bearings shall be composed of a Celcon inner bearing fixed to an aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.

      4) Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

      5) Dampers are to be designed for operation in temperatures ranging between -40°F and 212°F.

      6) All dampers shall be arranged within the air-handling unit to allow the actuators to be installed within the enclosure of the units and not mounted at the unit exterior unless otherwise noted on drawings. All dampers to be surface mounted to allow for direct connection of actuators on drive shaft.

      7) Where multiple dampers are installed end to end, satisfactory clearance shall be maintained between linkages to allow for actuator linkage connections. Actuation linkage not to be attached to face of damper. Minimum damper blade width shall be 6".

      8) Design Equipment: Tamco 1500 series, except dampers exposed to unmixed outside air shall be Tamco Series 9000.

      9) Make: Tamco.

      10) Acceptable Makes: Tamco, Ruskin.

9. Fan Inlet Air Flow Stations:

   a. Material: Base and shroud to be anodized aluminum, shedder to be ABS plastic.

   b. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

c. Temperature: 350°F continuous operation; 400°F intermittent operation.

d. Humidity: 0-100% continuous operation.

e. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

f. Corrosion Resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance.

g. Design Equipment: Paragon FE-1050.

h. Make: Paragon FE-1050, Air Monitor, Accutrol VorTek VTF

10. Outside Air Flow Measurement System:

a. Material: Element 6063-T5 anodized aluminum and casing 16 gauge G90 galvanized steel or PVC/ABS.

b. Accuracy: Within ± 0.5% of actual flow through the velocity range of 200 to 1,200 fpm when installed in accordance with published recommendation and within ±5% at a velocity of 100 fpm. Operating velocity range 100 to 2,800 fpm.

c. Temperature: -40°F to 120°F continuous operation.

d. Humidity: 0 to 100%.

e. Temperature compensation transmitter to calibrate airflow based on actual temperature and associated density properties.

f. Design Equipment: Paragon OAFE-1500.

g. Make: Paragon OAFE-1500, Accutrol VorTek, Air Monitor

11. Air Volume/Velocity Transducers for Duct Outside Air and Fan Inlet Airflow Stations:

a. The transducer shall be a combination differential pressure transmitter, square rood extractor, scaling multiplier, and output filter with process indication, complete in a single package.

b. The measured air volume shall be locally indicated on a door mounted LED display meter scaled in CFM.

c. The transducer package shall be a factory calibrated for the flow-measuring element being served.

d. A transducer shall be provided for each individual airflow station.

e. Accuracy shall be plus or minus 0.25%.

f. An output signal of 0-10 VDC or 4-20 mA shall be generated for monitoring by the DDC system.

g. Design Equipment: Accutrol.

h. Make: Paragon, Accutrol, Air Monitor.

I. Structural Design Criteria:

1. All wall panels, roof panels and internal component attachments to be fully supported by structural framing members integral to unit construction. Support from formed skins or panels as structural element alone is not acceptable. All fan/motor lift points and beams to be supported from floor base.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All tubing for filter gauges, airflow station, etc. shall be hard copper type with soldered joints. Provide maximum of 1'-0" of polyethylene tubing at connections to fans which are supported by vibration isolators.

B. Provide field pressure testing and fan vibration analysis of fully assembled unit. Submit all testing reports.

C. The unit manufacturer shall provide a factory on-site working supervisor for all phases of unit assembly.

D. Provide guards for all exposed shafts or fan wheels if not provided by fan manufacturer.

E. Pipe coil drip pans, humidifier and outside air sections independently to nearest floor drain, minimum pipe size shall be 1-1/2 in. Provide deep seal "P" trap and unions on both side of trap. The trap depth shall be greater than the static pressure of the section being drained. All other drain connection shall be piped with 1 in. piping manifolded together to the nearest floor drain. Provide each drain connection with ball valve and union.

F. The Contractor is responsible for cleaning of unit and repainting of any floor pans, interior walls, exterior walls, etc. that are damaged during rigging, assembly and final piping connections.

G. Air handlers shall be properly protected during shipment. Units shipped on unprotected flat-bed trailers shall be made all-weather-tight.

H. If air handlers need to be stored on site before installation within an enclosed building, all-weather-tight protection shall be maintained until the units are within an enclosed space.

I. Provide proper weatherization for protection of multi-section units during any periods of outdoor storage/staging, and during unit transport.

END OF SECTION

SECTION 238216.11 - COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Submit shop drawing on coils.

1.3 GENERAL REQUIREMENTS

A. Provide coils of proper size and rows to fit intended use and capacity as scheduled and specified. Location as shown on Plans. Designed for 125 psi. Same end or opposite end connections as required to fit installation shown on Plans. Vertical mounted coils shall have bottom drain headers. Duct mounted coils shall be equipped with flanges. Tag each coil at factory giving number and location. Coils completely drainable with auxiliary drain headers, if necessary. Minimum 1/2 in. drain and vent connections. Aluminum fins shall be a minimum of .0075 in. thick unless otherwise noted. Coils shall have brazed return "U" bends; bent tubes are not acceptable. Grooved connections are not acceptable. Fin spacing shall not exceed 12 fins per inch (FPI). Performance certified in accordance with ARI Standard 410.

PART 2 - PRODUCTS

2.1 REHEAT COILS

A. Tubing shall be .035 in. thick copper and shall have a minimum outside diameter of 5/8 in. Fins shall be of aluminum and wound on tubing individually. Fin spacing shall not exceed 12 fins per inch (FPI). Non-ferrous headers and connections with 304 stainless steel casings. Coils shall be tested by subjecting each coil to a minimum air pressure of 250 psig with the coil submerged in water. Counterflow heat transfer.

B. Design Equipment: Aerofin.

C. Make: Aerofin, Carrier, Daikin Applied, Trane, Heatcraft, Marlo

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions and so as to be compatible with intent of the respective system performance requirements.
Provide supporting ironwork and sheet metal safing to assure proper installation without any bypass air around coil.

B. Provide ample space during installation to allow for the removal of the coil. Provide all necessary unions, isolation valves, flexible connectors and accessories to allow for the removal and service of the coil.

C. Provide an access door upstream of all coils for inspection. Access door shall be minimum 16 x 16.

END OF SECTION

SECTION 238219 - FAN COIL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation shown on Contract Drawings.

1.2 SUBMITTALS

A. Submit product data for room fan coil units and accessories.

PART 2 - PRODUCTS

2.1 GENERAL

A. Baked enamel finish of color selected from manufacturers standard colors. Each piece of equipment boxed separately and tagged by room number.

B. Shall not exceed sound data as scheduled. Acoustical data is published manufacturer's data obtained by tests in accordance with ARI Standard 350-086.

2.2 CONSOLE FAN COIL UNITS

A. Cabinets:

1. 18 gauge steel removable front enclosure so that internal operating parts are accessible for service or replacement.

2. Bar supply grilles.

3. Isolated valve compartment.

4. Access to motor, fan assembly, and filters.

5. Type as required for job conditions.

6. Return air grilles.

7. Insulated drip pan for coil and valve sections.

8. Insulated cabinet with material in compliance with NFPA 90A requirements.

B. Heating Coils:

1. Copper tubes and headers, nonferrous fins.

C. Cooling Coils:

1. Copper tubes and headers, nonferrous fins.

D. Motors:

1. 0-10V, variable speed, brushless DC EC Motor.

2. Built-in overload protection.

3. Resilient mountings to dissipate noise and magnetic vibration.

4. Quick detachable motor cords.

5. Fan speed controllers shall be remote flush mounted type.

E. Drain Pan

1. The drain pan is to be externally insulated, noncorrosive (stainless steel) and double-sloped to allow condensate drainage. For units without external insulation as an option shall be field insulated. Coils mount above the drain pan, not in the drain pan - thus allowing the drain pan to be fully inspected and cleaned. The drain pan can also be removed for cleaning. The 3/4" main drain connection is at the lowest point of the drain pan. An auxiliary drain connection is provided on the same side as the main connection.

F. Options:

1. Disconnect switch.

2. Pleated throwaway filter.

a. The units are equipped with 2 in. flat pleated media filters and a minimum MERV 13 rating based on ASHRAE Standard 52.2.

3. Condensate overflow switch.

a. Units shall be arranged for horizontal installation above finished ceiling, with supply and return duct connections.

G. Design Equipment: Johnson Controls.

H. Make: Johnson Controls, Envirotec, Trane.

2.3 RECESSED FAN COIL UNITS

A. Arrangement:

1. Base unit designed for fully recessed wall or ceiling installation.

2. Features and accessories shall be the same as console type, except for the following:

a. Base casing shall be provided in lieu of finished cabinet.

b. Supply and return bar grilles as scheduled.

B. Design Equipment: Johnson Controls.

C. Make: Johnson Controls, Envirotec, Trane.

2.4 EXPOSED FAN COIL UNITS

A. Arrangement:

1. Base unit designed for exposed installation.

2. Features and accessories shall be the same as console type, except for the following:

a. Supply and return bar grilles as scheduled.

B. Design Equipment: Johnson Controls.

C. Make: Johnson Controls, Envirotec, Trane.

PART 3 - EXECUTION

3.1 GENERAL

A. Left hand or right hand piping connections for supply and return. Obtain complete instructions from unit manufacturer regarding each item and proper installation of same. Adjust motor speed.

3.2 INSTALLATION

A. In accordance with manufacturer's recommendations. Install piping within valve compartment to allow for pipe insulation. Provide drain piping. Vacuum clean inside of unit prior to operating units. Provide flexible duct connections at supply and return connections to ceiling units. For recessed and ceiling units, coordinate location of valves, fittings, filters, with access panels, to allow for convenient service of components. Install remote speed switch for recess and ceiling units. Provide wiring.

END OF SECTION

SECTION 238239 - UNIT HEATERS AND CABINET UNIT HEATERS (HYDRONIC AND ELECTRIC)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation and related work as shown on the Contract Documents.

1.2 SUBMITTALS

A. Submit product data for unit heaters and cabinet unit heaters.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Free from expansion and contraction noises and strains. Fan speed shown on Schedule shall not be exceeded. Each piece of equipment shall be factory-boxed and tagged by room number. Cabinet unit heaters and unit heaters shall have baked enamel finish with color selected by the Architect from manufacturer's standard colors. Rating in accordance with standard test codes adopted jointly by IUGA and ASHRAE.

2.2 UNIT HEATERS

A. General:

1. Wall hung or ceiling suspended.

2. Access for servicing the heating element, motors, and controls.

3. Horizontal discharge units with adjustable horizontal and/or vertical outlet vanes.

4. Vertical units with adjustable outlet louvers or diffusers.

B. Fan and Motor:

1. Statically and dynamically balanced.

2. Driven by totally enclosed EC motor with overload protection and lifetime lubrication.

    a. Solid state, digital control board with a three-speed switch.

C. Heating Element (Hydronic):

1. Serpentine coil, copper tube, aluminum fins, back or side connections to fit headroom requirements.

D. Heating Element (Electric):

1. Nickel-chrome wire embedded in refractory encased in steel sheath with spiral wound steel fins.

2. Each element protected form overheating with high temperature limit switch of automatic reset, snap-action thermostat type.

3. Supporting brackets attached to back to provide longitudinal movement for expansion and contraction.

4. Magnetic contactors and other control devices to operate at 120 volt line voltage. Include manual disconnect switch, and transformer to provide 120 volt for controls and if necessary, for fan motor.

5. Fan delay switch to dissipate coil heat after element de-energized.

E. Hydronic:

1. Design Equipment: Sterling

2. Acceptable Makes: Airtherm, Daikin Applied, Dunham-Bush, Sterling, Trane, Vulcan.

F. Electric:

1. Design Equipment: Q-Mark.

2. Acceptable Makes: Berko, Markel, Q-Mark.

2.3 CABINET UNIT HEATERS

A. General:

1. Rough-in dimensions must not exceed those of design equipment.

B. Cabinet:

1. Front and exposed parts, 16-gauge furniture steel, all others, 18 gauge steel.

2. Fronts shall be removable for access to interior parts.

3. Recessed or semi-recessed equipment to have four-side overlap, trim strips not acceptable.

C. Fan And Motor:

1. Fans, forward curved, centrifugal type, direct drive from motor shafts.

2. Driven by totally enclosed EC motor with overload protection and lifetime lubrication.

   a. Solid state, digital control board with a three-speed switch.

3. Shall be quiet in operation, not to exceed 45 db measured 5 ft. away, at high speed.

D. Heating Element (Hydronic):

1. Nonferrous construction, copper tube, aluminum fins.

2. Multipass serpentine design for high temperature drop.

3. Manual air vent. Automatic air vent is not acceptable.

E. Hydronic:

1. Design Equipment: Sterling

2. Acceptable Makes: Airtherm, Daikin Applied, Dunham-Bush, Sterling, Trane, Vulcan.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Provide equipment in accordance with manufacturer's printed instructions. Report untrue walls before installation. Report cases where clearance below suspended heaters is less than 7-1/2 ft. Provide clearance for piping or conduit. Support units independent of piping or conduit. Support units from building structure, with screws or bolts; no nailing allowed.

B. Be responsible for proper location and size of recesses. Coordinate installation of recessed or semi-recessed equipment in recesses. Provide framing in recess and shims. Use sponge rubber gasket air-seal between front enclosure and wall.

3.2 INSTALLATION - HYDRONIC

A. Provide valves and accessories and arrange to permit servicing. Coordinate correct end connections and coil arrangements.

B. Vertical cabinet heaters that are mounted on an existing wall shall be provided with continuous wood blocking that is painted to match the wall to infill any gaps created by the baseboard.

END OF SECTION

SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring.

Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final steam, condensate, hot water, chilled, drain connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent, gas, air, vacuum, lab gas connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of laboratory equipment and special equipment. Verify connection requirements before bidding.

END OF SECTION

SECTION 26 05 01 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The drawings are diagrammatic, unless detailed dimensioned drawings are included, and show only approximate locations of equipment, fixtures, panelboards, conduits, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Exact routings of conduit shall suit the job conditions.

B. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, the size and the quantity of branch circuit conductors, and the panel board or interconnection box from which the branch circuit is served.

C. Make measurements at the site and in the building during construction for all systems installed as the work progresses in such a manner that the equipment, piping, vents, ducts, conduit, and boxes will fit in the space available. Maintain headroom and if in unfinished areas, be as neatly installed, as obscure and "out-of-the-way" as physically possible. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and /or furnish other equipment as required for ample maintenance space.

D. Any changes in the size or location of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

1.2 QUALITY ASSURANCE

A. Electric equipment shall be installed in a neat and workmanlike manner. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.

B. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equal in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.3 SUBMITTALS

A. Submit product data for the following equipment, materials and products, including all fittings and accessories:

1. Conduit
2. Surface Raceway
3. Expansion Fittings
4. Cable Tray
5. Channel Support Systems
6. Conductors
7. Cables
8. Cable Termination and Splice Kits
9. Poke-Through Service Fittings
10. Terminal and Equipment Cabinets
11. Floor Boxes
12. Wiring Devices Including Dimmers
13. Telephone/Data Communication Outlets
14. Television Outlets
15. Extension Cord Reels
16. Clocks
17. Flashing, Sealing, Firestopping Materials
18. Salvageable Materials
19. Testing reports prior to energizing equipment and materials.

1.4 SALVAGEABLE MATERIALS

A. Salvageable materials will be reviewed and identified by the Owner. Items selected by the Owner shall be delivered to a selected location on the Owner's property by this contract in an equal condition to prior this work.

B. Items normally accepted as salvage by the Owner:

1. Transformers
2. Meters, meter sockets and test switches
3. Deadfront switchgear
4. Panelboards and covers
5. Circuit breakers
6. Disconnects (100 AMP and up)
7. Bus duct and apparatus
8. Adjustable speed drives
9. Motor starters
10. Luminaires
11. Fire alarm equipment
12. Nurse call and intercom
13. Motors above 1/2 HP and up
14. Environmental and automation control equipment
15. Telephones
16. Central clock system

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit, Raceway and Tubing:

1. Rigid Metal Conduit (RMC) shall be hot-dipped galvanized or electro-galvanized steel, UL listed "rigid metal conduit."

   a. Acceptable Manufacturers:

      1) Republic Conduit
      2) Allied Tube and Conduit
      3) Wheatland Tube
      4) Approved equal

2. Electrical Metallic Tubing (EMT) shall be electro-galvanized steel with corrosion resistant zinc coating; UL listed.

   a. Acceptable Manufacturers:

      1) Republic Conduit
      2) Allied Tube and Conduit
      3) Wheatland Tube
      4) Approved equal

3. Aluminum Conduit shall be rigid, heavy wall aluminum, UL listed "rigid metal conduit."

   a. Acceptable Manufacturers:

      1) Republic Conduit
      2) Allied Tube and Conduit

4. Flexible Metal Conduit (FMC) shall be constructed of one continuous length of electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges. Shall be UL listed "flexible metal conduit" or "liquidtight flexible metal conduit" as required.

   a. Acceptable Manufacturers:

      1) Republic Conduit
      2) Allied Tube and Conduit
      3) Wheatland Tube
      4) AFC (American Flexible Conduit) Cable Systems

5. Rigid Non-Metallic Conduit (Schedule 40 for concrete encasement, Schedule 80 for direct burial or where exposed) shall be UL listed "rigid non-metallic conduit" for application in underground, encased, and exposed applications in accordance with the NEC". The conduit shall be made from polyvinyl chloride (PVC) and shall be rated for 90ºC conductors. Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3, UL-651, and UL-514

    a. Acceptable Manufacturers:

        1) Carlon
        2) Heritage Plastics
        3) PW Eagle

6. PVC Coated Rigid Metal Conduit, prior to coating shall conform to the specifications for Rigid Metal Conduit, above. The conduit shall have hot dipped galvanized threads, and the threads and the inside of the conduit shall be urethane coated. The exterior of the conduit shall be PVC coated to a minimum thickness of 40 mils. All coated conduit shall conform to NEMA standard RN01. The conduit shall be bendable without damage to the interior or exterior coatings. All fittings and couplings shall be PVC coated to a minimum thickness of 40 mils on the exterior, and the interior and threads shall be urethane coated. All screws shall be stainless steel. The installed conduit system shall provide a continuous grounding path.

    a. Acceptable Manufacturers:

        1) Robroy Industries
        2) Ocal Incorporated
        3) Perma-Cote
        4) Approved Equal

7. Surface Metal Raceway shall be .040 in. steel UL listed "Surface Metal Raceway". Use manufacturer's standard fittings designed to be used with the specific raceway.

    a. One-Piece Raceway:

        1) Finish per architect.

        2) Acceptable Manufacturers:

            a) Wiremold "700" Series (Design Make)
            b) Mono Systems
            c) Approved equal

    b. Two-Piece Raceways:

        1) Finish per architect.

2) Duplex or special receptacles as specified in wiring devices.

3) Corners, turns, tees and elbows shall have suitable turning radius for the intended cable.

4) Provide divider in raceways utilized for power and communications. Utilize wire/cable clips 18 in. on center to hold in the conductors/cables.

5) Utilize rounded head screws/bolts for mounting.

6) Acceptable Manufacturers:

a) Wiremold 6000 (Design Make)
b) Mono Systems
c) Approved equal

8. Electrical Non-Metallic Tubing (ENT) for installation in accordance with the National Electrical Code, other applicable sections of the Code, and local codes.

a. Any ENT used shall meet the requirements of NEMA TC-13 and shall be listed by Underwriters Laboratories, Inc., as suitable for its intended purpose.

b. ENT shall be recognized by a CABO National Evaluation Report for use in one (1) hour and two (2) hour rated construction.

c. Penetration of fire rated walls, floors, or ceilings, shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Building Materials Directory.

d. Fittings and outlet boxes shall be designed for use with ENT and listed by Underwriters Laboratories. All fittings, boxes, and accessories shall be from one manufacturer.

e. Only cement recommended specifically for use with the brand of ENT used shall be used.

f. Unless indicated differently on drawings, ENT systems shall be color coded BLUE for brand and feeder circuit wiring, ORANGE and YELLOW for communications, and RED for fire alarm and emergency systems.

g. Acceptable Manufacturers:

1) Carlon
2) Heritage Plastics
3) Approved equal

B. Conduit Fittings:

1. Fittings for rigid metal conduit shall be fully threaded and shall be of the same material as the respective raceway system. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2 in. and double screw indenter fittings for conduits 2 in. and larger. Connectors shall also have insulated throat or plastic insulating bushing up to and including 1 in. size. For sizes 1-1/4 in. and larger, provide plastic insulating bushing. Die-cast, pressure cast fittings shall not be used. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.

   a. Acceptable Manufacturers:

      1) O.Z. Gedney
      2) Steel City
      3) Thomas & Betts
      4) Crouse-Hinds
      5) Carlon

2. Expansion Fittings shall be watertight, combination expansion and deflection type designed to compensate for movement in any direction. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless steel bands, use aluminum body fittings for rigid aluminum conduit.

   a. Acceptable Manufacturers:

      1) Crouse-Hinds, Type "XD"
      2) O.Z./Gedney, Type "DX"
      3) Approved equal

3. Explosion-proof conduit sealing fittings shall be threaded, cast iron alloy construction with integral bushings. Seal with "A" sealing compound after wiring installation. The fittings shall be UL Listed for Class I, Division 1 and 2, Groups B, C, D; Class II, Division 1 and 2, Groups E, F, G; Class III.

   a. Acceptable Manufacturer's:

      1) Crouse-Hinds EYS Series
      2) Emerson/O.S./Gedney EYS Series
      3) Emerson/Appleton EYS Series

C. Wireway, Wire Trough, and Auxiliary Gutters:

1. Wireway and Wire Trough shall be hinged cover type wireway with provisions for full lay-in along the entire length of run. Wireway shall be steel, enclosed with gray enamel finish. Provide NEMA 1 units for interior/dry/clean locations and NEMA 12 for interior dry maintenance/shop/utility locations. Size to meet NEC fill requirements or larger as noted on Contract Documents. Provide knockouts along runs. Recess in wall where required for flush mounted equipment.

Hinge shall be on the bottom of front face for horizontal mounting. Provide all covers, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, tees, pullboxes, hangers, reducers, supports, and other fittings to match and mate with wireways as required for complete system.

a. Acceptable Manufacturers:

1) Square D "Square Duct"
2) General Electric
3) Hoffman
4) Meco

D. Cable Trays:

1. Solid Bottom Cable Trays shall be aluminum construction, including accessories. One-piece construction bottom and side, sheet aluminum 080 ±5%. Aluminum alloy side rails and bottom channel with flanges in standard lengths 12 ft. - 0 in. long. Wrap around type bolted connector to connect tray sections. Cover required where indicated on Contract Documents and in all areas used as return air plenums. Use three-piece construction, consisting of a solid corrugated bottom welded to the side rails. Provide divider strip where noted on Contract Documents. Minimum inside radius of horizontal elbows shall be 12 in. Provide special radius elbows where required for field conditions. Horizontal and vertical bends for solid bottom trays shall have solid bottoms. Loading data:

Tray Width	Load Depth	Usable NEMA Depth	Standard	Span	Lbs. Per Feet	Deflection
12 in.	4 in.	3 in.	12B	10 ft.	115	0.15 in.
18 in.	4 in.	3 in.	12B	10 ft.	115	0.015 in.
18 in.	6 in.	3 in.	12C	10 ft.	144	0.15 in.

a. Provide a safety-loading factor of 1.5 for uniformly distributed loads when supported as a simple span in accordance with the NEMA standard listed.

b. Acceptable Manufacturers:

1) P-W
2) B-Line Systems
3) Chalfant
4) Globe

E. Strut-Type Channel Raceways and Fittings:

1. Strut-Type Channel Raceways and Fittings shall be provided for racking of conduit, trapeze suspensions, equipment support, cable racks and panel racks. Channel shall be steel with electroplated zinc finish for interior dry locations.

Provide necessary accessories such as bolts, screws, anchors, connection plates, and straps as required to perform the necessary functions. Wet location and exterior channel support systems shall be steel with hot dipped galvanized finish and stainless steel hardware as a minimum. Cut ends shall be touched up with suitable matching finish. Provide poured-in-place inserts for supporting channels at poured concrete walls and ceilings.

a. Acceptable Manufacturers:

1) Unistrut
2) Globe
3) Kindorf
4) B-Line

F. Low Voltage (600V or less) Conductors and Cables:

1. Conductors shall be insulated for 600 volts, unless otherwise noted, and shall be standard AWG and kcmil sizes. Conductors shall be 98% copper, thermal plastic or cross-linked polymer insulated, heat and moisture resistant. Conductors shall be stranded, except for conductors used for fire alarm system wiring. Conductor sizes No. 18 AWG and smaller shall be a solid single strand; No. 16 AWG and larger shall be multiple stranded. Minimum conductor size shall be #12 AWG except smaller sizes may be used for communications and special systems. Conductor sizes shall be as called for. Conductors shall be labeled with UL seal and be marked with the manufacturer's name, wire size and insulation type. Insulation for all 600 volt conductors shall be Type THHN/THWN-2 or Type XHHW-2, unless otherwise noted. All exterior and underground conductors shall be XHHW-2. Luminaire fixture wire shall conform to the latest Underwriters Laboratories requirements. Flexible cords and cables for general portable use shall be Type SO or SOOW or as noted. Cables for special use shall be of the type specified for the application.

a. Color Coding:

1) All circuits shall be color coded according to the following schedule.

	Three Phase 120/208V	**Three Phase 277/480V**
Ground	Green	Green
Neutral	White	Gray
A or L1	Black	Brown
B or L2	Red	Orange
C or L3	Blue	Yellow
Isolated EG	Green w/Yellow Tracer	Green w/Yellow Tracer

b. Acceptable Manufacturers:

1) General Cable (Brand of Prysmian Group)
2) Prysmian
3) South Wire
4) Okonite
5) Senator

2. Mineral Insulated (MI) Cable:

a. Cable shall be a manufactured system rated for two (2) hour fire rating minimum and be NRTL tested for such. System shall be rated 600V, continuous 90°C minimum and have a main copper conductor, magnesium oxide insulating material and outer soft drawn copper sheath. Jacket of low smoke material with conductor size and rating markings labeled.

b. Utilize manufacturer termination kits for entry into boxes, panelboards, etc. Maximum of 6 ft. distance between cable supports and secured to fire rated building structure. Manufacturer installation instructions/recommendations shall be strictly followed. Provide phasing color coding utilizing tape at each enclosure, box and junction.

c. Acceptable Manufacturers:

1) Pyrotenax
2) Approved equal

3. Terminal Lugs and Connectors:

a. The lug shall be capable of continuous operation at the current rating of the cable it is used on. The lug shall be UL listed per UL 486A, using industry standard crimping tools and dies. Terminal lugs shall be solderless, pressure type with UL label for "CU/AL" conductor terminations. The lug shall be a closed-end compression (crimp) type, constructed of seamless, alloy suitable for copper and/or aluminum conductors to match the conductor. The lug shall be made with a chamfered inside end, for ease of conductor insertion.

Both one and two hole lugs shall be NEMA sized for standard stud sizes and spacing. The lug shall be designed for use at the system voltage.

1) Acceptable Manufacturers:

a) 3M Scotchlok 30,000 and 31,000 Series
b) Burndy
c) O.Z./Gedney
d) Thomas and Betts

b. The conductor connection shall be capable of continuous operation at the current rating of the cables it is used on. The connection shall be UL listed per UL 486A, using industry standard crimping tools and ides. The connector shall be an inline compression (crimp) type, constructed of seamless, tin-plated copper. The connector shall be constructed with chamfered inside-ends and with center cable stops. The connector shall be designed for use at the system voltage.

1) Acceptable Manufacturers:

a) 3M Scotchlok 10,000 and 11,000 Series
b) Burndy
c) O.Z./Gedney
d) Thomas and Betts

c. "Split-bolt" Connectors shall be solderless type.

1) Acceptable Manufacturers:

a) Burndy
b) Kearney
c) O.Z./Gedney
d) Thomas and Betts
e) Anderson

d. "TWIST ON" Connectors shall be spiral steel spring type and insulated with vinyl cap and skirt.

1) Acceptable Manufacturers:

a) 3-M Company "Scotch-Lok"
b) Ideal "Wing-Nuts"
c) Approved equal

e. Aluminum joints shall utilize oxide inhibitors as recommended by the conductor manufacturer. Utilize pin type terminations where possible and coordinated with the clearances available. Provide insulating tape or insulating sealed cover for connectors/terminations.

G. Outlet Boxes, Device Boxes, Rings, and Covers:

1. Outlet Boxes having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit or cable fittings, or cables, with provisions for mounting outlet box cover. Outlet boxes shall be galvanized steel, not less than 2-1/2 in. deep, unless restricted by the surroundings, 4 in. square or octagonal. Boxes and associated fittings, plates and devices shall be mechanically fastened (screwed), friction fitting is not acceptable. Outlet boxes exposed to moisture, surface mounted, exterior, wet or damp locations shall be cadmium cast alloy complete with external threaded hubs and gasketed screw fastened covers.

Minimum box size shall be as indicated in the NEC for the conductors and devices installed. Boxes shall be approved for the environmental condition where they will be installed.

2. Conduit bodies providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point and listed in accordance with outlet box requirements.

3. Extension ring intended to extend sides of outlet box or device box to increase box, volume, or both

    a. Acceptable Manufacturers:

        1) Steel City
        2) Raco
        3) Appleton
        4) Crouse Hinds

4. Telephone/Data Communications Outlet Boxes:

    a. 4 in. x 4 in. outlet box with single gang plaster ring with cover plate suitable for indicated communications outlet and conduit routed to accessible ceiling space / accessible corridor ceiling space cable tray. Cover plate shall match the receptacle cover type.

5. Pull and junction boxes shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type covers. Boxes installed in damp or wet locations shall be of raintight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated NEC for conduit and conductor sizes installed. Boxes shall be approved for the environmental condition of the location where they will be installed.

    a. Acceptable Manufacturers:

        1) Hoffman
        2) Keystone
        3) Approved equal

6. Flush floor junction boxes shall be recessed cover boxes designed for flush mounting in masonry. Provide checkered plate gasketed cover suitable for foot traffic. Make: O.Z. Gedney Type YR or approved equal.

7. Corrosion Resistant Boxes:

    a. Provide corrosion resistant boxes for sewage pump stations, natatoriums, etc. and where indicated.

b. Plastic Coated Outlet Boxes: threaded hub type, malleable iron boxes coated with 40mils thick polyvinylchloride coating, Ocal/T&B Ocal Blue System, PCD Corp. KorKap XL or Robroy Industry Plastibond or Perma-Cote.

c. Nonmetallic Boxes: Glass fiber reinforced polyester, Carlon Himeline Series, Crouse-Hinds Krydon or Robroy Industry Stahlin.

8. Hazardous location conduit junction boxes shall be used in hazardous locations to provide for change in conduit direction, access to conductors, and as pull and splice boxes. They shall be copper free aluminum, with internally threaded bodies and cast in brackets on the cover. The boxes shall be UL Listed for Class I, Division 1 and 2, Groups B, C, D; Class II, Division 1 and 2, Groups E, F, G; Class III.

a. Acceptable Manufacturers:

1) Crouse-Hinds EGJ Series
2) Emerson/O.Z./Gedney GUEB Series
3) Emerson/Appleton DER/GUB and GUBM Series

9. Flush Floor Boxes: Boxes shall be cast in place with height adjustability prior to pour. Provide power, communication and/or audio/visual outlets as indicated. Installation shall be suitable for the intended floor finish: if carpet, then provide a carpet flange, if tile/terrazzo/concrete finish, then provide a collar flush with finished floor and no flange. Units shall meet UL scrub water protected requirements. To have integral ground terminal.

a. Acceptable Manufacturers:

1) Acceptable manufactures shall include those called for in the Contract Documents.

10. Flush Poke-Through Service Fitting (Power/Communication):

a. Provide flush poke-through suitable for installation in a cored floor opening. Shall be complete with junction box, conduit and conduit adapter for transition from the floor box to movable partitions or with flush devices as indicated on plans. The complete assembly shall be suitable for two hour fire rated floors, be UL CEYY listed and have UL scrub water protected metallic color as selected by the Architect cover and trim ring. Cover shall be suitable for carpet, tile, wood and concrete. Unit protrusion above floor plane shall not exceed 0.2". Extend or reduce unit raceway length as needed to accommodate floor thickness and project conditions. Provide indicated devices in units.

b. Acceptable Manufacturers:

1) Acceptable manufactures shall include those called for in the Contract Documents.

H. Terminal and Equipment Cabinets:

1. Terminal and equipment cabinets shall be code gauge galvanized steel with removable endwalls. Fronts shall be of code gauge steel, flush or surface type (as indicated) with concealed trim clamps, concealed hinges, flush lock, and grey baked enamel finish. Boxes and front shall be UL listed and shall be minimum 35 in. H x 24 in. W x 6 in. D. Provide removable insulated plywood terminal board mounted on inside back wall of cabinet.

   a. Acceptable Manufacturer:

      1) Square D "Mono-Flat"
      2) Approved equal

I. Wiring Devices:

1. Wiring Devices (toggle switches, key switches, receptacles, dimmers, occupancy sensors, etc.) shall be commercial grade as a minimum. Switch handle and receptacle face shall be as directed by the Architect. Receptacles connected to the emergency power system shall have a red colored face. Provide device cover plates of rounded nylon colored to match the device in finished areas and rounded raised (Steel City 450/460 series) only for surface mounted locations in unfinished areas. Provide neoprene gasketed cast aluminum/zinc box with hinged (for receptacle) rain tight cast aluminum/zinc lockable while in use cover with stainless steel hardware for devices designated "WP".

   a. Acceptable Manufacturers:

      1) Pass and Seymour
      2) Hubbell
      3) Leviton

2. Toggle/Snap Switches:

   a. Units shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, 90° rear plug in termination with pig tail, with nylon/polycarbonate toggle, self grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20. Single pole units shall be Hubbell HBL1221, P&S 20AC1 or Leviton 1221-2. Provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model.

   b. Momentary Contact: Units shall be as indicated above (20A, 277V, nylon handle, side/back wired), three position, two circuit/three wire with spring return to center position, provide where indicated and as needed for proper system operation. Hubbell HBL 1557, P&S 1250, Leviton 1256 or approved equal. Provide keyed operation or pilot light where indicated. When used for lighting controls for vacancy sensor control, provide jumper across the circuit terminals.

3. Receptacles:

   a. Provide receptacles where indicated on the drawings and where called for. Provide type receptacle as indicated and if not indicated then utilize general receptacle.

   b. General Receptacle: Units shall be NEMA 5-20R, duplex, 20A, 125V, 90° rear plug in termination with pig tail with nylon face, indented brass contacts for three point connection, self grounding stainless steel mounting screw clip plate and green ground terminal. Shall meet requirements of Federal Specification W-C-596, NEMA WD-6 and UL 498.

      1) Units shall have 0.036" brass thick contacts, 0.05" thick brass mounting strap, and be: Hubbell HBL5362, P&S 5362A or Leviton 5362.

   c. Ground Fault Interrupting Receptacles: Units shall be as specified above for General Receptacle and have 5mA interrupting ground fault level, test/reset front buttons, full through feed capability, power off on reverse wired sensing, 10kA short circuit current rating, be tamper/weather resistant and in compliance with UL 943. Unit shall self-test function to periodically test the components automatically and indicate a failure condition utilizing an LED. Shall be Hubbell GFR5362, P&S 2096TR or Leviton S7599TR.

   d. Tamper Resistant Receptacles: Units shall be as specified above for General Receptacle and have protective shutters to prevent entry into the line or grounded front openings unless all plug prongs are present.

   e. Surge Protected Receptacles: Units shall be as specified above for General Receptacle and have 240 joule energy/15,000A capacity, three modes of protection (line to neutral, line to ground and neutral to ground), 500V maximum clamping, LED indicator (operational, failure), blue color and UL 1449 compliant. Shall be Hubbell HBL5360SA, P&S 5352XSP or Leviton 5280.

   f. Isolated Ground Receptacles: Units shall be as specified above for General Receptacle and have an orange color and electrically independent/isolated mounting strap and ground terminal. Shall be Hubbell IG5352, P&S IG5362 or Leviton 5362IG.

   g. Surge Protected and Isolated Ground Receptacles: Units shall be as specified above for General Receptacle and the Surge Protected and Isolated Ground units above. The unit shall have an orange color.

   h. Controlled Receptacle: To be utilized where a receptacle is automatically controlled. Units shall be as specified above for General Receptacle with suitable symbol on face. Shall be Hubbell DR20LA, P&S 26352CD or approved equal.

i. USB Power Receptacle: Units shall be as specified above for General Receptacle but have 0.040" zinc plated mounting strap, two 20A 125V outlets and two USB charging (5A minimum total, 5VDC, USB 2.0/3.0) outlets. Overall depth shall not exceed 1.7 in. Shall be Hubbell USB20 or approved equal.

j. Clock Receptacle: To be NEMA 5-15R single receptacle with hanger and stainless steel cover plate. Hubbell HBL 5235 or approved equal.

k. Special Receptacles: provide other type receptacles as indicated herein or on the drawings. Such receptacles shall be Hubbell, P&S or Leviton highest grade available.

4. Extension Cord Reels:

a. Ceiling mounted. Positive stop action at any length, ratchet lock, and automatic rewind spring. Provide heavy duty type with 20 ft. of #12/3 SJEO minimum cord terminating in molded high impact outlet box with wire mesh cord grip and P&S #5362A or HBL 5362 receptacle (brown), and spring close cover plate. Provide rigid mounting support to building structure.

b. Acceptable Manufacturers:

1) Hubbell HBL45123R20 (Design Make)
2) Woodhead
3) Appleton RL5000 Series

5. Time Switches:

a. Electromechanical Controllers:

1) DPST, 40A per pole at 277 volt: Tork 7202Z.

2) 3PST, 40A per pole at 277 volt: Tork 7302Z.

3) Two-circuit lighting control center: Tork T-920L.

4) Three-circuit lighting control center: Tork T-903-L.

b. Digital Time Switch (for use with Contactor):

1) SPDT, 7-day with 14 set points.

2) Digital, AM/PM Clock with LCD display.

3) Battery backup to keep program in memory for approximately seven (7) days.

4) 120V Make: Tork EW120 or equal.

5) 277 Make: Tork EW120-3 or equal.

c. Time switches shall be provided with NEMA 1 general purpose, surface mount enclosures unless otherwise noted.

6. Elapsed Time Switches:

a. Mechanical spring wound timer, which requires no electricity to operate the timing mechanism. Device shall fit a standard 2-1/2 in. deep wall box. Switch contacts shall break current carrying contacts at the end of the timed cycle.

1) 0-30 Minutes: Tork A530M or equal.
2) 0-4 Hours: Tork A504HH or equal.
3) 0-12 Hours: Mark Time or equal.

7. Emergency Shutdown Pushbutton:

a. Where called for provide emergency shutdown/emergency power off push button. Unit shall be Square D Class 9001 Type K NEMA 13 oil tight pushbutton with the following:

1) Red mushroom head 1-1/2 in. button, hinged protective flip up cover, push to operate, pull to reset.

2) Maintained contact operation with one normally open and one normally closed 10A 120V contacts. Provide relay for additional contacts.

3) Red pilot light.

4) Engraved legend plate indicating "XX - Emergency Stop" with XX = the system name.

8. Cable Rack Assembly: Non-metallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

a. Support Stanchions: Normal 36 in. high by 4 in. wide, with minimum of nine (9) holes for arm attachment.

b. Arms: Arranged for secure, drop-in attachment in horizontal position at any location of cable stanchions, and capable of being locked in position. Arms shall be 12 in. minimum and rated for twice the intended weight as a minimum. Top of arm for cable support shall be nominally 4 in. wide, and arm shall have slots along full length for cable ties.

c. Support shall have rounded corners and be securely fastened to the arm and cable fastened to it with tie wrap or other recommended method.

d. Hardware: All hardware shall be stainless steel.

J. Flashing, Sealing, Fire-stopping:

1. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

a. Provide materials and products listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.

b. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

c. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

d. The methods used shall incorporate qualities, which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

2. Acceptable Manufacturers:

a. Dow Corning Fire-Stop System Foams and Sealants
b. Nelson Electric Fire-Stop System Putty, CLK and WRP
c. S-100 FS500/600, Thomas & Betts
d. Carborundum Fyre Putty
e. 3-M Fire Products

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA NEIS (National Electrical Installation Standard) latest edition.

B. Unless otherwise noted, wiring for all systems indicated in the contract documents shall consist of insulated conductors installed in raceways. Raceways shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond raceways to all boxes and cabinets so that each system of raceways is electrically continuous throughout. Unless otherwise indicated on the drawings, install all wiring in the following raceway system:

1. Wiring 600 Volts or Less in Dry Locations: EMT.

2. Wiring 600 Volts or Less in Dry Locations and Subject to Physical Damage: RMC.

3. Wiring 600 Volts or Less in Outdoors, Above Grade Locations: RMC.

4. Wiring 600 Volts or Less Installed Below Grade, in Concrete Floor Slabs or Below Ground Floor Slab: PVC-40 encased in concrete with rigid metal conduit bends and penetrations through building floors and walls.

5. Wiring Installed in Hazardous Locations: Galvanized Rigid Metal Conduit.

6. Wiring Installed in Corrosive Locations: PVC-80, RMC-PVC**.**

7. Flexible metal conduit shall be used for final connection to all motors, final connection to rotating or vibrating equipment, final connections to dry type transformers and final connections to recessed lighting fixtures. Liquidtight flexible conduit shall be used in all wet or damp locations. Maximum length of flexible conduit shall be 36 in., except that from outlet boxes to lighting fixture maximum length shall be 6 ft. Provide green insulated equipment grounding conductor in all flexible metal conduit.

8. Surface metal raceway shall be used for surface runs in finished area where concealed conduit cannot be run or where specifically indicated on drawings.

C. Raceways:

1. Sized as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, and type of the insulation conductors to be installed. Raceways shall be minimum 3/4 in. trade size for branch circuit wiring and minimum 1 in. trade size for all telephone, data, intercommunications, instrumentation, fire alarm, television and computer systems and for all branch circuit "Home Runs" to panelboards. Installed to provide adequate grounding between all outlets and the established electrical system ground.

2. Arranged in a neat manner for access and allow for access to work installed by other trades.

3. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts handtight, plus one-quarter turn more.

4. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4 inch trade size and insulated throat metal ground bushings on 1-1/2 inch trade size and larger conduits terminated with locknuts. Install throat metal grounding bushings on service conduit.

5. Complete raceway installation before starting conductor installation.

6. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 feet above finished floor. Wherever a cluster of four (4) or more raceways rise out of floor exposed, provide neatly formed 6 in. high concrete envelop, with chamfered edges, around raceways.

7. Installed with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the raceway. Factory made bends are acceptable and should be considered for raceways larger than 2 in.

8. Make bends in raceway using large-radius performed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.

9. Conceal conduit within finished walls, ceilings, and floors unless otherwise noted, or where permitted by the Owner's Representative. All exposed raceways shall be painted to match existing adjacent surface as directed by the Architect. Install conduit parallel or perpendicular to building lines.

10. Support conduit within 12 inches of enclosure to which attached.

11. Seal raceway opening that penetrate rooms or walls with acoustical requirements on both sides of rooms or walls with acoustically rated putty or firestopping.

12. Differing Temperatures: For raceways routed between areas with differing temperatures (interior to exterior, walk in coolers/freezers, environmental chambers, etc.) install raceway as follows:

    a. Provide a thermal break, 4 in. minimum of stainless steel or Schedule 40 PVC conduit within space wall/separation.

    b. Seal raceway penetration through the wall/separation.

    c. Provide a box on each side of the space wall/separation.

    d. Provide raceway interior sealant (duct seal or suitable foam) to provide a complete air barrier after conductors are installed.

    e. Mounting of raceway and boxes on equipment shall be coordinated and approved by the equipment manufacturer.

    f. Installed with exterior surfaces not less than 6 in. from any surface with normal operating temperature of 200°F or higher.

13. Expansion-Joint Fittings:

    a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg. F and that have straight-run length that exceeds 25 feet. Install in runs of aboveground RMC and EMT conduit that are located where environmental temperature change may exceed 100 deg. F and that have straight-run length that exceeds 100 feet.

    b. Install expansion fittings at locations where conduits cross building or structure expansion joints.

    c. Install with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

    d. Installed such that no undue stress is placed on any electrical raceway due to the proper functioning of expansion joints.

14. Raceway installed in wet/damp locations or on exterior walls shall have a spacer manufactured for this purpose provided to maintain a space/void between the mounting surface and the raceway.

15. Do not install conduits within 2 inches of the bottom side of a metal deck roof.

16. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

17. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs. Bush where necessary.

18. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

19. Plugged at the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.

20. Installed with UL approved rain-tight and concrete-tight couplings and connectors.

21. Raceways shall not be attached to or supported by wooden plug anchors or supported from mechanical work such as ductwork, piping, etc.

22. Raceways installed in concrete slabs shall be located so as not to affect structural integrity of slab, and such that conduit shall have a minimum of 1 in. of concrete cover on all sides.

Obtain approval from the Owner's Representative prior to installing conduit larger than 1 in. trade size in concrete slabs. Raceways in slabs shall be for floor box use only, or routing vertically through.

23. Raceways installed below ground floor slab shall be encased in concrete with 3 in. minimum coverage on all sides. Where possible, install conduit directly below slab with concrete envelope poured monolithic with slab. Where this is not possible, support raceways and envelop maximum 5 ft. - 0 in. on centers from underside of structural slab by means of galvanized pipe hangers. Pipe hangers shall be coated with asphalt mastic. Installation shall maintain integrity of waterproofing membrane.

24. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.

25. Become familiar with the general construction of the building and place sleeves, inserts, etc., as required. All penetrations through existing floors shall be core drilled and sleeved.

26. All raceways shall be supported adequately by malleable iron pipe clamps or other approved methods. In exterior or wet locations, supports shall allow not less than 1/4 in. air space between raceway and wall. Firmly fasten raceway within 3 ft. of each outlet box, junction box, cabinet or fitting. The following table lists maximum spacing between conditions, strength of supporting members, etc.

27. Furnish and install such supports at no additional cost to owner.

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
1/2 in., 3/4 in.	Concealed	7	10
1 in., 1-1/4 in.	Concealed	8	10
1-1/2 in. and larger	Concealed	10	10
1/2 in., 3/4 in.	Exposed	5	7
1 in., 1-1/4 in.	Exposed	7	8
1-1/2 in. and larger	Exposed	10	10

28. Where raceways puncture roof, install pitch pockets as required in order that the roof warranty is maintained. Coordinate with representative of roofing material manufacturer.

29. At each flush mounted panelboard, terminal cabinet, control cabinet, etc., provide four (4) spare 3/4 in. raceways from panelboard, etc., to an area above the nearest accessible ceiling space. Make 90° turn above the ceiling, arranged for further continuation of raceway, and cap.

30. All interior conduit used for the following systems shall be color coded as follows:

    a. Red - Fire Alarm System

    b. Metallic (silver/grey) - Normal utility power

    c. Yellow - Emergency Life Safety Branch

    d. Purple - Emergency Optional Standby

D. Cable Trays:

1. Tray supports shall be hung using threaded, galvanized rod hangers, with rods extended through support steel and double nutted. Size support member within load rating of member section; and without visible deflection. Install cable tray level and straight.

2. Provide aluminum body expansion connectors at building expansion joints. Minimum 4 in. movements, greater if expansion movement conditions warrant. Provide aluminum body expansion connectors every 100 ft. for outdoor installations. Minimum 4 in. movement, greater if expansion movement conditions warrant.

3. Provide external grounding strap at expansion joints, crossovers and at other locations where tray continuity is interrupted.

4. Provide necessary elbows, tees, crosses, risers, offsets, fittings, reducers, connectors, clamps, rod suspension, trapeze hangers, etc., as required to make a complete job, coordinate with the manufacturer.

5. Provide conduit to tray fitting at each conduit entrance to tray.

6. Install divider in trays as called for.

7. Install fire stop wall frames around cable tray at penetrations through fire rated walls, and where called for. Seal these openings with pliable fire resistant sealant.

E. Outlet Boxes:

1. Consider location of outlets shown on drawings as approximate only. Study architectural, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Owner's Representative for decision prior to installation. Comply with the NEC relative to position of outlet boxes in finished ceilings and walls.

2. Prior to installation, relocate any outlet location a distance of 5 ft. in any direction from location indicated on drawings if so directed by the Owner's Representative. Prior to completion of wall construction, adjust vertical height of any outlet from height indicated if so directed by Owner's Representative. The above modifications shall be made at no additional cost to the Owner.

3. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Outlet boxes shall be sized to accommodate the wiring, splices and device(s) to be installed in accordance with the NEC.

4. Saw-cut opening for boxes recessed in masonry walls in center of cell of masonry block and install box flush with surface of wall. Box shall have extra-deep type raised tile covers or shall be 3-1/2 in. deep boxes with square corners and dimensions to accommodate conductors installed. Prepare block surfaces to provide a flat surface for a raintight connection between box and coverplate or supported equipment and box, whether installed indoors or outdoors.

5. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

6. Locate boxes so that cover or plate will not span different building finishes. Install a device cover plate over each and every outlet indicated on drawings. Do not install plates until painting, cleaning and finishing of surfaces surrounding the outlet are complete. Install single one-piece multi-gang covers over multi-gang devices.

7. Where outlets at different mounting heights are indicated on drawings adjacent to each other (due to lack of physical space to show symbol on drawings), install outlets on a common vertical line.

8. Where switch outlets are shown adjacent to strike side of door, locate edge of outlet box approximately 3 in. from door frame.

9. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

10. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

11. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

12. Floor outlet boxes shall be installed flush with finished floor, adjust level and tile as required. Where finished floor is terrazzo, provide boxes specifically designed for installation in terrazzo. Where floors are to receive carpet or flooring material, coordinate with appropriate trade and provide insert. Rectangular covers shall be parallel and perpendicular with the building or, if used, floor tile/floor joints/pattern. Coordinate cover type with the flooring and device type.

13. Outlet boxes installed in plaster, gypsum board or wood paneled hollow cavity walls shall be installed flush with raised plaster covers or raised tile covers. Boxes shall be mechanically fastened and supported by two (2) adjacent structural members (studs) with cross brackets (Garvin Industries Model BMB or approved equal).

14. Surface ceiling mounted outlet boxes shall be minimum 4 in. square, 1-1/2 in. deep, galvanized sheet metal.

15. Surface wall mounted outlet boxes shall be cast type boxes.

16. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

17. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

18. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty for boxes and enclosures in areas of walls with acoustical requirements. Provide gaskets for wallplates and covers.

19. Seal openings and knockouts in back and sides of boxes and enclosures in areas of walls with lead shielding requirements.

F. Wiring Methods:

1. Conductors shall not be installed until raceway system, including all outlets, cabinets, bushings and fittings, is completed. Verify that all work of other trades which may cause conductor damage is completed. Use only U.L. approved cable lubricants when necessary. Do not use mechanical means to pull conductors No. 8 or smaller.

2. In general, conductors shall be the same size from the last protective device to the load.

3. Wiring systems shall be properly grounded and continuously polarized throughout, following the color-coding specified. Connect branch circuit wiring at panelboards, as required, in order to provide a "balanced" three-phase load on feeders.

4. Provide insulated green ground conductor in each branch circuit.

5. All feeder connections shall be made to bus and other equipment using solderless, pressure type terminal lugs.

6. Branch circuits connected to a 20A circuit breaker shall be sized as indicated except for lengths exceeding 75 ft. For circuits longer than 75 ft. to 100 ft. utilize No. 10 AWG conductors (line, neutral and ground) and for circuits from 100 ft. to 150 ft. utilize No. 8 AWG (line, neutral and ground) unless otherwise indicated. Conduit size shall be modified in accordance with the NEC.

7. For splices and taps, No. 10 AWG and smaller, use solderless "twist on" connectors having spiral steel spring and insulated with a vinyl cap and skirt.

8. For splices and taps, No. 8 and larger, use insulated solderless set screw AL/CU or hydraulically compressed sleeve fittings suitable for the intended use.

9. Use cast connections for ground conductors.

10. Provide minimum 6 in. of spare/slack of each conductor in each junction or pull box and termination.

11. Make all splices and connections in accessible boxes and cabinets only.

12. Cover uninsulated splices, joints, and free ends of conductor with rubber and friction tape of PVC electrical tape. Plastic insulating caps may serve as insulation. Heat shrink sleeves shall be acceptable for crimp type splices.

13. On termination at branch circuit outlets, leave a minimum of 8 in. free conductor for installation of devices and fixtures.

14. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner's Representative and receive written approval for splicing prior to installation of feeder(s). Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors as near equal as possible.

15. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equal.

16. Provide conduit seals and explosion proof devices as indicated on the plans and as dictated by the NEC for all hazardous locations indicated on the drawings.

17. Lighting fixtures, detectors, etc., in mechanical equipment, boiler and pump rooms shall be installed with exposed wiring after equipment, ductwork, piping, etc., are in place. In general, lighting shall be as located on the drawings; where conflicts exist, locate lights for best distribution.

18. Fire proof tape all medium voltage cables in handholes, man holes, building entrance and junction/pull boxes.

19. Medium voltage cables shall be installed, terminated and tested by trained and qualified personnel with a minimum of 5 years' experience. Training shall be for all types of installations and for the specific types of splices/terminations. Installation shall be in accordance with the cable manufacturer and IEEE. Provide circuit tagging with engraved phenolic plate attached with UV resistant tie wrap indicating source, circuit # and date installed with 3/16 in. test.

20. Provide cable/conductor vertical support in accordance with the NEC.

21. The following systems are permitted to be installed in cable tray in compliance with the NEC:

    a. Communication cable.

    b. Security cable.

G. Receptacles:

1. Ground opening shall be up for vertical installation and on the left for horizontal installation.

H. Toggle Switches:

1. Switches shall be installed in accessible locations near room/space entryway(s).

2. Provide lighted handle switches in mechanical rooms, elevator pits, electric rooms, etc.

3. Switches shall have neutral pulled through the box even if not used.

I. Junction and Pull Boxes:

1. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and size as require by the National Electrical Code.

J. Equipment Mounting Heights: Coordinate with architectural interior and exterior elevations.

1. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:

a.	Toggle switches (up position "on")	46 in.
b.	Wall lighting controls (dimmer, digital switch, etc.	46 in.

c.	Receptacle outlets (long dimension vertical, ground" pole farthest from floor)	18 in.
d.	Receptacle outlets above counters	8 in. above counters
e.	Receptacle outlets, above hot water or steam baseboard heaters. Do not install receptacle outlets above electric baseboard heaters	30 in.
f.	Receptacle outlets, hazardous areas; also for refrigerators	48 in.
g.	Receptacle outlets, weatherproof, above-grade	24 in.
h.	Clock outlets (104 in. AFF or 10 in. below ceiling, whichever is lower) For large, high spaces, coordinate with Architect.	104 in.
i.	Telephone outlets	18 in.
j.	Telephone outlets, wall mounted	46 in.
k.	T.V. outlet	18 in.
l.	Fire alarm manual stations	46 in.
m.	Fire alarm combination audio/visual and standalone visual device (entire strobe lens at heights indicated)	80 in. to bottom of the notification device
n.	Standalone fire alarm audio device	90 in. (min) to 96 in. (max)
o.	Distribution panelboards, to top of backbox	72 in.
p.	Terminal cabinets, control cabinets, to top of backbox	72 in.
q.	Disconnect switches, motor starters, enclosed circuit breakers.	48 in.

2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Owner's Representative for approval to change location before installation.

K. Hangers and Supports:

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, large circuit breakers, pendant mounted lighting fixtures, etc.

2. Panelboards, disconnect switches, circuit breakers, cabinets, large pull boxes, adjustable speed drives, cable support boxes and starters shall be secured to the building structure and not supported from conduits. Small panelboards, etc., as approved by Owner's Representative, may be supported on walls. Racks for support of conduits and heavy electrical equipment shall be secured to building construction by substantial structural supports.

L. Identification:

1. Provide engraved lamicoid identification nameplates on switchboards, main service disconnects, transfer switches, motor control centers and on all panelboards using designation shown in panelboard schedule. Include voltage, phase, equipment served, voltage source to panel or equipment.

2. Provide engraved lamicoid identification nameplates for each circuit breaker in the main distribution panel listing the panelboard or equipment connected to each device.

3. Provide engraved lamicoid identification nameplates on all items of equipment including individual circuit breaker enclosures and disconnect switches, listing the equipment connected to the particular device provided under Specification Section 262000, including, but not limited to: starters, disconnect switches, adjustable speed drives, circuit breakers, etc. Include voltage, phase, equipment served, voltage source to panel or equipment.

4. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker. Directory shall be placed in a plastic clear sleeve in the interior of the panelboard door. Provide type written updated panelboard directories for existing panelboards affected by this work.

5. Nameplates shall be engraved black, with white core, with Helvetica medium 3/16 in. lettering. 1/8 in. lettering is acceptable where space of 3/16 in. is not available.

6. Identify junction and pullboxes for particular service and circuit such as power, emergency power, lighting, fire alarm, telephone, interphone, public address, nurse call, etc. using stencil lettering on cover.

7. Where voltage exceeds 600V provide permanent signage indicating "DANGER - HIGH VOLTAGE - KEEP OUT". Provide signage at each electrical room indicating "DANGER - ELECTRICAL ROOM". Utilize adhesive backed, yellow background, block lettering signage at door.

8. Using adhesive backed printed tape label (white background, black lettering) all receptacle and switch coverplates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to outside of receptacle or switch coverplates.

M. Spare Parts:

1. Deliver to Owner and obtain receipt for spare parts including key switches, fuses, etc.

3.2 TESTS

A. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform the function for which they are designed. For all feeder and exterior branch circuit wiring rated 600 volts or less, provide 1,000 volt "Megger" insulation test prior to energizing feeders. Use a 1,000-volt motor driven megger for all tests. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors. Document test results and submit for approval prior to energizing conductors.

END OF SECTION

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide grounding system equal to or exceeding the requirements of NEC and as indicated in the contract documents. Raceway system which includes metal conduit, wireways, pull boxes, junction boxes, busway, wire ways, cable trays, enclosures, motor frames, etc., shall be made to form a continuous, conducting permanent ground circuit of the lowest practical impedance to enhance the safe conduction of ground fault currents and to prevent objectionable differences in voltage between metal non load current carrying parts of the electrical system.

B. Provide solid grounding of building structures and electrical and communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits and systems. Types of grounding systems include the following:

1. Electrical Service and Transformer Grounding
2. Building Grounding
3. Equipment Room Ground Terminal Bar
4. Electrical Equipment Grounding
5. Surge Protection Device (SPD) Grounding
6. Telecommunications Grounding
7. Equipotential Grounding Systems
8. Underground Distribution Grounding
9. Common Ground Bonding with Lightning Protection System

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions. etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in the NEC by Nationally Recognized Testing Laboratory (NRTL) and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

1.3 REQUIREMENTS

A. Grounding conductors, bonding conductors, jumpers, grounded conductors, etc. shall be sized in accordance with the NEC.

B. Equipment and materials shall be installed in accordance with the manufacturer's recommendations.

1.4 SUBMITTALS

A. Provide submittals for the following:

1. Ground rods and connectors.

2. Ground bars.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conductors:

1. Exposed grounding components such as bars, straps, cables, flexible jumpers, braids, shunts, etc., shall be bare copper unless otherwise indicated.

2. Grounding conductors in raceway with 600V circuiting shall be insulated to match the circuit conductors with green color.

3. Grounding conductors used with system voltage greater than 1000V shall be bare unless otherwise indicated.

4. Grounding conductor size shall be as indicated or as required by the NEC whichever is larger, stranded, soft drawn or soft annealed copper, unless otherwise indicated. Sizing shall take into account circuit voltage drop.

5. Acceptable Manufacturers:

a. Same make as for 600 volt conductors.

B. Ground Rods:

1. Provide solid copper or copper clad steel cylindrical rods, 3/4 in. minimum diameter and minimum 10 ft. long with pointed end. Provide units suitable for extension connection when ground rods longer than 10 ft. are indicated.

2. Acceptable Manufacturers:

a. Copperweld
b. Erico
c. Burndy

d. Approved equal.

C. Connectors, Clamps and Terminals:

1. Mechanical connectors and clamps shall be made of copper alloy or silicon bronze. Solderless compression terminals shall be copper, long-barrel, NEMA two bolt. Bolts and washers (Belleville) shall be of comparable material or stainless steel.

a. Acceptable Manufacturers:

1) Burndy
2) Hubbell Anderson Corp.
3) Thomas & Betts
4) Approved equal

2. Exothermic Welds:

a. Provide exothermic welds designed for size and type of intended cable, rods, structure, etc. Solder prohibited for connections, except for medium and high voltage cable metallic tape shields (utilize mechanical and solder).

b. Acceptable Manufacturers:

1) Erico "Cadweld"
2) Burndy "ThermOweld"
3) Approved equal

3. Pipe Clamp:

a. Pipe clamp for bonding to pipe type electrode (water pipe, etc.) shall be a suitably sized copper alloy clamp.

b. Acceptable Manufacturers:

1) Burndy GAR-BU
2) O-Z Gedney Type CG
3) Burndy "Durium"
4) AFL Global "Everdur"
5) Approved equal

4. Flexible Strap:

a. Flexible grounding straps shall be of braided high conductivity copper with two hole connector. Strap shall have equal to or greater than ampacity of the system it is bonding to. Strap shall provide flexibility in all directions when installed properly.

b. Acceptable Manufacturers:

1) Burndy
2) OZ Gedney
3) Approved equal

5. Electrostatic Floor Bonding:

a. Listed grounding kit for bonding ESD carpet, vinyl, rubber and epoxy floor coverings and coatings to ground with the following components:

1) 1 in. wide copper grounding tape.

2) Heavy gauge stainless steel ground termination plates with double sided conductive tape and 20 in. long lead wire with a #10 terminal ring at the end.

3) Acceptable Manufacturers:

a) Ground Zero Electrostatics Inc. "Zerostat" Floor Termination and Grounding Kits.

D. Ground Bars

1. Provide ground bars where indicated. Ground bars shall be:

a. 98% conductive copper, minimum.

b. 4 in. x 1/4 in. thick minimum with length as indicated with minimum 36 in. for electric room/MDF and all other minimum of 24 in.

c. Standard NEMA bolt hole patterns with maximum quantity of lug locations. Spacing of 1-1/8 in. apart.

2. Bar shall be mounted to an accessible wall location with galvanized steel hardware and 2000V rated insulators. Mounting shall be suitable for full complement of cabling.

3. Unit shall conform to EIA/TIA standards.

4. Acceptable Manufacturers:

a. Erico
b. Newton Instrument
c. Burndy
d. Harger

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding Conductors:

1. Provide grounding conductor(s) with all power circuits. Conductor shall be sized as indicated or as required by the NEC as a minimum and shall be terminated on the equipment, device, enclosure, etc. grounding terminal. Conductor size shall be for the entire length unless approved by the Engineer where oversized for voltage drop.

2. Conductors above grade to ground electrodes (water piping, structural column, etc.) and to equipment (service entrance, ground bars, ground halos, etc.) shall be installed in metallic conduit with ends bonded to the conduit.

3. Grounding conductors shall be installed to have a minimum radius of 3 in.

4. Grounding conductors in a raceway system shall be terminated/bonded to each box, cabinet, enclosure, etc. through which it passes or terminates.

5. Grounding conductors routed with underground circuits shall be bonded to each ground electrode and metallic cable support system within the raceway system including pull and access locations.

6. Stranded conductors penetrating vapor barriers, foundations, slab on grade and water stop membranes shall have the interstitial spaces between strands filled with solder 4 in. beyond the membrane each side. The conductor shall be sealed to the membrane with a manufacturer approved method.

B. Raceway Systems:

1. All metal supports, cable trays, messenger cables, frames, sleeves, brackets, braces, etc. for the raceway system, panels, switches, boxes, starters controls, etc., which are not rigidly secured to and in contact with the raceway system, or which are subject to vibration and loosening, shall be bonded to the raceway system.

2. Termination of rigid conduit at all boxes, cabinets, and enclosures shall be made up tightly with a double locknut arrangement and a bushing, bushings being of the insulated type. Utilize grounding bushings as specified elsewhere in these specifications.

3. Conduit which runs to or from boxes, cabinets, or enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and hence impair the continuity of system ground circuits shall be provided with bonding jumpers connected between a grounding type bushing/locknut on the conduit and a ground bus or stud inside the box, cabinet, or enclosure and attached thereto.

4. Conduit expansion joints and telescoping sections of metal raceways shall be provided with bonding jumpers sized in accordance with the NEC.

C. Ground Rods:

1. Ground rods shall be driven vertically the full length plus 24 in., minimum.

2. Ground rods shall be located in virgin soil or loamy compacted soil.

D. Connectors Clamps and Terminals:

1. Connectors utilized above grade in dry accessible locations shall be mechanical or exothermic type.

2. Connectors in damp locations, below grade or if not indicated shall be exothermic type.

3. Clean the area near the connecting surfaces prior to any connection to ensure effective contact. Cleaning shall be to the bare metal. Wire brush area if needed to remove rust scale paint, dirt, etc. to expose bare metal.

4. Exothermic connections shall be installed in accordance with the manufacturer's recommendations and tested with heavy blow of a five pound sledge.

E. Flexible Strap:

1. Flexible straps shall be used when bonding vibrating/moveable equipment, with expansion fittings and where recommended by the manufacturer.

2. Sufficient slack shall be provided to compensate for the anticipated vibration, movement and expansion.

F. Primary Electrical Equipment/Systems:

1. Transformers:

a. Primary voltages including those above 600 volts.

b. Provide a minimum of two #4/0 bare ground conductors from the transformer pad electrodes or building main ground bar to the transformer enclosure ground stud/pad/terminals.

c. Provide a #4/0 bare ground conductor from each lightning arrester to the transformer enclosure ground stud/pad/terminals.

d. For exterior pad mounted transformers, provide a bonding conductor sized in accordance with the NEC from the transformer neutral terminal to the ground stud/pad/terminals.

e. Connect system primary and secondary circuit grounding conductors to the transformer enclosure ground stud/pad/terminals.

2. Metal Enclosed/Metal Clad Switchgear:

a. Equipment includes metal enclosed/metal clad switch units, switch and fuse units, auxiliary units, metering units, air circuit breaker units, etc. these shall be effectively grounded in accordance with requirements described herein and the manufacturers recommendations.

b. Provide two (2) #4/0 ground conductors from the equipment ground bus to the ground bar or one (1) #4/0 ground conductor from the equipment ground bus to the building ground bar for every two (2) compartments in a continuous line-up equipment, whichever is the greater number.

c. Connect system circuit grounding conductors to the equipment ground bus.

3. Cabling:

a. All medium and high voltage cable shielding shall be bonded to the local ground system in all buildings, switchgear, transformers, manholes containing splicing/connectors, etc. Suitable terminations, connectors, splices, etc. should be used to expose the cable shield for grounding.

b. The grounding conductors contained in the interstices of interlocked armor cable shall be connected to the ground bus at every equipment termination point and to each other and to system ground; ground at every splice location.

c. The grounding conductor contained in raceway systems shall be connected to the ground bus at every equipment termination point and to each other and to system ground; ground at every splice location.

G. Secondary Electrical Systems:

1. The neutral (grounded) conductor of each low voltage, single and/or polyphase system or distribution system, except special isolated double insulated systems, shall be solidly connected to ground at the transformer neutral bushing, or at the main secondary switchgear to the system ground, and shall be sized for current carrying capacity, not to be less than as required by the NEC. Ground connection shall be to the building grounding system, building steel, building water service, building concrete reinforcement and as indicated.

2. Provide equipment grounding conductor, green colored insulation, with phase conductors, to primary side of all transformers rated 600 volts or less circuited to the enclosure and secondary neutral bushing, to all electrical utilization and distribution equipment; insulation shall be same type as phase conductors. Transformer enclosures shall be bonded to the primary and secondary circuit grounding conductor.

3. Equipment grounding conductors shall extend from the point of termination back to the ground bus of the source panelboard, switchboard, transformer, or switchgear.

H. Equipment Grounding:

1. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch circuit conductors.

2. Surge Protection Device (SPD) Ground Conductor Installations: Extend SPD dissipation ground conductors to local equipment ground bus and to common grounding electrode conductors. Size conductors per SPD manufacturer recommendations and the NEC.

I. Communications Rooms:

1. For each building communications room or closet provide one (1) wall mounted ground bar bonded to the main building ground bar or electrical service ground with insulated #4/0 AWG conductor.

2. Local cable trays, equipment racks, etc. shall be bonded to the ground bar with insulated #6AWG minimum.

J. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors in conduit from building's main service equipment or grounding bus to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a bolted clamp connector or by bolting a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

K. Underground Distribution:

1. Manholes and Handholes: Provide a driven ground rod through opening in the floor/bottom with 4 in. exposed. If necessary due to the site conditions, install the ground rod prior to manhole/handhole installation and provide a #1/0AWG bare conductor from the ground rod with an exothermic connection in the manhole/handhole. Seal the opening with waterproof nonshrinking grout.

2. Bond exposed parts within manhole/handhole such as inserts, pulling rings, cable racks, ladders and cable shields to the ground rod with #2AWG bare conductor minimum. Conductors shall be neatly installed around the perimeter of the unit and support 3 ft. on center with non-corrosive support and hardware.

3.2 GROUND TERMINAL BUS INSTALLATION

A. Install ground terminal bar in rooms where shown on the drawings. Mount bar 18 in. above finished floor by anchors and bolts using 1-1/2 in. long insulated spacer between bar and wall. Use a minimum of two (2) supports 18 in. on center. Connect all grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar.

B. Label grounding conductors terminated to bus for equipment, location, electrode, etc served.

3.3 TESTS

A. Test the building ground system before backfilling to ensure continuity and determine system resistance value.

B. Testing procedure shall be a fall of potential type with a moving auxiliary electrode in accordance with IEEE Standard 142 and reviewed/approved by the Engineer. Sufficient test points shall be taken for accurate resistance value.

C. Make resistance measurements in dry weather, no earlier than 48 hours after rainfall. Provide tabulated test results indicating distance between rods and resistance readings on a plotted graph.

D. Test each ground electrode system separately prior to connection to the system or main building ground bar. Test each system ground electrode system a second time after backfilling has occurred and all final connections (building steel, water service, etc.) have been made.

E. Soil type, date, time, meter manufacturer/model number, person performing the test, test witnesses and most recent rainfall shall be noted in test submittal.

END OF SECTION

SECTION 262000 - ELECTRIC DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a complete distribution system as indicated on the Contract Documents and as specified herein.

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

1.3 SUBMITTALS

A. Submit the following product data/information:

1. Manufacturer and equipment type.

2. Standard catalog information sheet.

3. Detailed shop drawings indicating plan, elevation, end and isometric views. Top and bottom conduit areas shall be clearly shown and dimensioned on the drawings.

4. Single-line diagram.

5. Complete Bill of Materials.

6. All relevant ratings including, but not limited to, voltage, current, interrupting and withstand.

7. Overcurrent Device Information. Model number, available settings, setting ranges, capabilities, etc.

8. Submit available and final settings, programming and adjustments.

B. Submit product data and information for the following equipment, materials, products, etc.:

1. Dry type transformer(s) including shielded and linear load transformer(s).

2. Distribution and branch circuit panelboards.

3. Enclosed circuit breakers.

4. Disconnect switches.

5. Surge Protective Devices.

1.4 WARRANTY

A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 and a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Dry-Type Transformers:

1. Transformers to be factory-assembled and tested, air-cooled ventilated units for 60 Hz service. Transformers that require internal or external fan assisted forced air cooling to obtain ambient air (AA) rated kVA are not acceptable. Transformers 15 kVA and less shall have 185°C insulation system and shall be designed not-to-exceed 115°C rise above 40°C ambient. Transformers 30 kVA and higher shall have 220°C insulation system and shall be designed not-to-exceed 115°C rise above 40°C ambient. Insulation systems shall be U.L. listed. Cores shall be manufactured from a high-grade, non-aging, silicon steel with high magnetic permeability, low hysteresis and eddy current losses, one leg per phase, and grounded to enclosure. Cores shall be clamped with structural angles and bolted to the enclosure to prevent damage during shipment or rough handling. Remove clamping after installation. Coils shall be continuous winding except for taps, copper, vacuum impregnated with non-hydroscopic thermosetting varnish and shall have a final wrap of electrical insulating material designed to prevent injury to the magnet wire. Transformers having coils with magnet wire visible will not be acceptable. 30 KVA, and larger, floor mounted. Under 30 KVA, wall mounted. Provide Mason type ND, Korfund or Vibrex vibration isolation devices for each transformer. Provide ground bar kit or a ground bar installed on the inside of the transformer enclosure.

2. Ratings: Shall be as indicated on the “Transformer Schedule” or as noted on the drawings. IEEE #C57, NEMA and US Government requirements shall apply. The transformer efficiencies shall meet or exceed the requirements of New York State and the US Department of Energy.

3. For transformers up to 300 kVA, provide with 6-2-1/2% full capacity taps, 2-FCAN (for connections above nameplate) and 4-FCBN (for connections below nameplate). For transformers above 300 kVA, provide 4-2-1/2% fully rated taps, 2-FCAN and 2-FCBN.

4. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:

   a. Square D
   b. Eaton Corporation
   c. ABB

2.2 MATERIALS

A. Distribution Panelboards (Nominal 600 Volt):

1. Provide distribution panelboards as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal magnetic, molded case circuit breakers as scheduled.

2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure, main lugs, and main breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50°C rise above ambient.

3. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.

4. Each panelboard, as a complete unit shall have a short circuit rating equal to or greater than the rating shown on the Panelboard Schedule. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. The use of series rating of panelboards for short circuit rating is not acceptable.

5. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets shall be equipped with locks and all locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge, full-finished steel with rust-inhibiting primer and baked enamel finish.

6. The panelboard interior assembly shall be dead front with panelboard front removed. Panelboard front shall be door in door construction with full length piano-hinge. Main lugs or main breakers shall be barriered on five (5) sides. The end of the bus structure opposite the mains shall be barriered.

7. Panelboards shall be UL listed for use intended.

8. Ratings shall be as indicated in the contract documents.

9. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:

   a. Square D "I-Line" - Design Make.
   b. Eaton Corporation "PRL3"
   c. General Electric by ABB

B. Branch Circuit Panelboards (480Y/277 volt, 208Y/120 volt):

1. Provide branch circuit panelboard as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal-magnetic, molded case circuit breakers as scheduled.

2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67.

3. Provisions for additional circuit breakers shall be such that field addition of connectors or mounting hardware will not be required to add circuit breakers to the panelboard. Bus connections shall be bolt-on.

4. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the rating shown on the Panelboard Schedule or on the plans. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. Reducing breaker ratings on the basis of series rating is not acceptable.

5. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be specified in UL Standard 50 cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. Each front shall include a door and have a flush, stainless steel, cylinder type lock with catch and spring-loaded door pull. All panelboard locks shall be keyed alike. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge, full-finished steel with rust inhibiting iron phosphate sealer and baked enamel finish. Minimum box width shall be 20 in. Provide door-in-door construction. Panelboard to be keyed to match the Owner's existing system.

6. Ratings shall be as indicted on the Panelboard Schedule.

7. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

   a. 480Y/277 Volt:

      1) Square D "NF" - Design Make.
      2) Eaton Corporation "PRL2"
      3) General Electric by ABB

   b. 208Y/120 Volt:

      1) Square D "NQ" - Design Make.
      2) Eaton Corporation "PRL1"
      3) General Electric by ABB

C. Circuit Breakers:

1. Circuit breakers below 200 amp frame shall be molded case constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

2. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes. Single pole 15 and 20 ampere circuit breakers shall be UL listed as “Switching Breakers” at 120V ac or 277 V ac and carry the SWD marking. Lugs shall be mechanical, rated for 60/75° AL/Cu.

3. Thermal Magnetic Circuit Breakers: Inverse time current element for low level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit breaker frame sizes 250A and larger.

4. Adjustable, Instantaneous Trip Circuit Breakers – Magnetic trip element with front mounted, field adjustable trip setting.

5. Electronic Trip Circuit Breakers (400A frame and above and where indicated on drawings): 100% rated, RMS sensing, field replaceable rating plug or electronic trip, digital display of settings, trip targets, and indicated metering displays with multi-button keypad and ten-event, trip history log, and front field adjustable settings for long time, long time delay, short time, short time delay, instantaneous trip, ground fault, zone interlock for ground fault and short trip, programmable with handheld unit as indicated. Ability to turn instantaneous off.

   a. Square D Micrologic trip unit - Design Make.

b. Eaton Corporation Optim 550 trip units for circuit breakers 400 – 1600 amp frame or RMS 610 trip units for 2000 amp frame to 6000 amp frame.

c. ABB Spectra RMS or MicroVersa trip unit.

d. Provide a test set for each type of solid state trip unit.

6. Shunt Trip: 120V trip coil energized from separate circuit, with coil-clearing contact.

7. Key Interlock Kit: Externally mounted to prohibit circuit breaker operation; keying shall follow sequence indicated on drawings.

8. Handle Padlocking Device: Fixed attachment, for locking circuit breaker in on or off position.

9. Ground-Fault Circuit Interrupter (GFCI) circuit breakers shall be quick-make, quick-break, thermal-magnetic, Class A, 6 milliampere ground fault sensing and trip indicating, and multipole breakers shall have common trip. The ground fault circuit breakers shall not occupy any more space than a standard breaker of the same number of poles.

10. Ground Fault Equipment Protector (GFEP) circuit breakers shall be utilized for electric heating equipment and where indicated. These shall be quick-make, quick-break, thermal-magnetic, Class B, 30 milliampere ground fault sensing and trip indicating, and multipole breakers shall have common trip. The ground fault circuit breakers shall not occupy any more space than a standard breaker of the same number of poles.

11. Arc-Fault Circuit Interrupter (AFCI) circuit breakers shall be quick-make, quick-break, thermal-magnetic, and trip indicating, and multipole breakers shall have common trip. Sensor shall recognize the unique current or voltage signatures associated with arcing faults and efficiently interrupt the circuit to reduce fire hazards. Sensor shall detect persistent low current arcing faults down to 5 amps with associated mitigation of fire hazards in the cords connected to the outlets.

12. Dual Function Circuit Breakers shall provide both GFCI and AFCI protection. Circuit breaker shall have the same electrical requirements as the individual devices listed above.

13. Arc Flash Energy Mitigation: Provide the following arc flash energy mitigation system for all circuit breakers 1200A and larger.

a. Arc Energy Reduction Maintenance Switch: Equipment main circuit breaker shall have a selector switch in the front of the unit enclosure and another remotely mounted at the entrance to the room for maintenance periods. The switch shall be 30mm metal Square D type K and labeled “Normal” and “Maintenance”. The normal position shall utilize the standard trip settings of the breaker.

The maintenance position shall utilize a quicker series of trip settings to reduce the potential arcing energy. The selector switch shall have a protective flip up cover. LED warning light on the face of the unit enclosure shall indicate when in the maintenance mode and have appropriate signage. The system shall be fully wired and tested by a factory authorized/trained technician.

14. Listed combination of coordinated circuit breakers shall be verified by the equipment manufacturer utilizing published data sheets. Confirmation listings shall be submitted.

15. Ratings shall be as indicated in the Contract Documents.

16. Enclosed circuit breakers shall be molded case, thermal-magnetic type, ratings as noted, with overcenter, trip-free, toggle-type operating mechanism, quick make/quick break action and positive handle indication. Multiple pole breakers shall be common trip type. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each phase. Provide provisions for padlocking in the "off" position. Breakers shall be calibrated for operation in an ambient temperature of 40°C and shall be suitable for mounting and operating in any position. Breakers shall have removable lugs, UL listed for copper and aluminum conductors. Breakers shall be installed in NEMA 1 general purpose, surface enclosures, unless otherwise noted. UL listed as suitable for use as service equipment.

    a. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

        1) Square D
        2) Eaton Corporation
        3) ABB

D. Power Meter:

1. Where indicated on the drawings, provide a factory installed unit mounted power meter with the following parameters:

    a. LCD or LED display.

    b. Line voltage control power.

    c. Voltage input with overcurrent protection and disconnecting means.

    d. True RMS voltage and current measurement.

e. Metered parameters: Phase current, line voltage, phase voltage, frequency, power factor per phase and three phase total, real power per phase and total, reactive power per phase and total, apparent power per phase and total, total real energy, total reactive energy, total apparent energy, user configured sliding window for real, reactive and apparent power peak demand. Sampling rate shall be 512 sample points per cycle minimum. Waveform capture with adjustable triggers.

f. Accuracy: Energy, and demand power: 0.2% in accordance with ANSI C12.20Instrument current transformers shall be factory wired to shorting blocks to prevent open-circuiting the current transformers under energized conditions. The meter shall also be user programmable for current to any CT ratio.

g. Capable of metering up to 480 volts without external potential transformers. The meter shall also be user programmable for voltage range to any PT ratio.

h. Communications: Modbus RTU, TC/IP, etc.

i. Acceptable Manufacturers:

1) Equipment (Unit Manufacturer)
2) Square D
3) Eaton Corporation
4) Shark

E. Disconnect Switches:

1. Shall be heavy-duty type three-pole, with "Quick Make/Quick Break" operating handle mechanically interlocked with the cover, horsepower and voltage rated to match equipment served. Where indicated switches shall be provided with dual-element, time delay, rejection type fuses. Switches shall be installed in NEMA 1 for indoor use, NEMA 4X for outdoor use. Provide provisions for padlocking in the "off" position. Provide neutral bar in single phase or three phase, four wire circuits, and ground bar in all switches. Provide auxiliary contacts where called for.

2. All disconnects connected downstream of ASD's shall have a normally open and normally closed auxiliary contacts which shall be wired to the ASD to indicate disconnect is open.

3. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

a. Square-D - Design Make.
b. Cutler Hammer.
c. General Electric by ABB

F. Fuses:

1. All fuses rated 600 volts and below shall be rejection type dual-element, time-delay type. Provide two (2) complete sets of fuses for all fusible devices. Deliver spare fuses to the Owner and obtain receipt.

2. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

   a. Fuses 600 Amperes and Below: Bussman Type FRS-R (600 volts), Bussman Type FRN-R (300 volts) or equivalent.

   b. Fuses Rated Above 600 Amperes: Bussman Type KRP-C or equivalent.

G. Surge Protective Device:

1. Device shall be rated for location as shown on drawings.

2. Seven Mode Protection: Line-to-neutral (three), line-to-ground (three) and neutral-to-ground.

3. Provide test report from a recognized independent testing laboratory verifying the Surge Protective Devices (SPD) can survive published surge current rating on both a per mode and per phase basis. ANSI/UL 1449, latest edition.

4. Surge Current Capacity – The minimum total surge current tested with the ANSI/IEEE C42.41, 20 kA-8/20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

	Application	Peak Surge Current Per Phase	Nominal Discharge Current – In Per Mode
a.	Type 1 – Before Service Entrance	250 kA	20 kA
b.	Type 2 – After Service Entrance	160 kA	20 kA

5. Unit shall comply with ANSI/UL-1449, latest edition. Voltage Protection Rating (VPR) per Mode must not exceed the following for Type 1 SPD:

   a. 208Y/120, L-N 700 volts, L-G 700 volts, N-G 800 volts, L-L 1000 volts.

   b. 480Y/277, L-N 1200 volts, L-G 1200 volts, N-G 1200 volts, L-L 2000 volts.

6. Unit shall comply with ANSI/UL-1449, latest edition. Voltage Protection Rating (VPR) per Mode must not exceed the following for Type 2 SPD:

   a. 208Y/120, L-N 800 volts, L-G 700 volts, N-G 800 volts, L-L 1000 volts.

   b. 480Y/277, L-N 1000 volts, L-G 1200 volts, N-G 900 volts, L-L 1800 volts.

7. UL-1283 bi-directional high frequency noise attenuation for electric line noise shall be 50 dB at 10 kHz-100 MHz.

8. Short Circuit Current Rating: 200 KAIC.

9. Indication system:

   a. A green/red LED indicator for each phase.
   b. Flashing trouble light.
   c. Shall alarm open circuit damage, thermal conditions and overcurrent.

10. Transient surge counter.

    1) Provide dry contact for remote monitoring.

11. External mounted model.

12. Manufacturers:

    a. Square D
    b. Eaton Corporation.
    c. L.E.A./Dynatech.
    d. Vertiv
    e. Current Technology

2.3 SHORT CIRCUIT PROTECTION, COORDINATION AND ARC FLASH STUDY

A. The contractor shall provide an electrical power systems study as described below and submitted for approval prior to final equipment submission. Submit documents/drawings of complete short circuit, coordination and arc flash study for the electric distribution system for this project including the service entrance to all branch circuit panelboards and branch circuits 50A and over. Documents shall be prepared by a licensed Professional Engineer in New York State with at least 5 years' experience in similar studies, using the most current software version of SKM Power Tools. Study documentation shall include:

1. Software used to prepare study with a description of the software philosophy.

2. Quantities, ratings and characteristics of all system components.

3. Impedance data for each piece of equipment.

4. Calculation methods and tabulations.

5. One-line diagrams and impedance diagrams.

6. Service entrance characteristics (available short circuit, X/R ratio, voltage, etc).

7. Available short circuit at each node in the system with associated required equipment ratings.

8. Coordination verification with equipment settings and time current graphs.

9. Arc flash energy level at each piece of equipment with adhesive labels.

10. Conclusions and recommendations.

B. Short Circuit Current:

1. Perform short circuit current calculations to determine the available short circuit current at each piece of distribution equipment.

2. Calculations shall take into account the following:

a. Available utility short circuit current.

b. System impedances (transformers, conductors, etc.).

c. Conduit types.

d. Motor contribution for motors.

C. Coordination:

1. Electrical distribution system shall be fully coordinated from the service entrance to branch circuit over current protection.

2. Emergency electric distribution system shall be fully coordinated from the service entrance to the branch circuit over current protection.

3. The coordination shall meet the current edition of ANSI/IEEE Standard 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems. The study shall indicate that this standard was used as the basis for the study.

4. Field settings, adjustments and minor modifications necessary for conformance with the recommendations shall be accomplished without additional expense to Owner. Provide documentation that all applicable over current protective devices have the recommended settings and have been suitably calibrated.

5. Coordination graphs shall indicate coordination proposed for systems indicated on log-log graph forms. Coordination graphs shall include:

a. Complete descriptive titles.

b. Graph for all over current devices.

c. Thermal damage curves (conductors, transformers, etc.), available short circuit current limits, rated current levels and over current protective device operation bands. Over current protective device operation bands shall be for the recommended settings.

d. Indication that applicable devices are inherently selectively coordinated with associated back up list from the manufacturer.

e. Listing of all project over current devices with manufacturer and model number.

f. Recommended settings for all adjustable over current protective devices.

6. Equipment design discrepancies and proposed corrective modifications if required shall be submitted with studies with variations clearly note.

D. Arc Flash:

1. Arc flash evaluation shall be provided to determine the arc flash energy at each piece of distribution equipment. Calculation shall be in accordance with IEEE 1584 and NFPA 70E.

2. Two separate arc flash energy levels shall be calculated and displayed on separate labels in locations that an arc flash energy reduction maintenance switch is utilized to indicate the energy with and without the switch engaged.

3. Arc flash calculations shall utilize finalized and approved over current protective device settings.

4. Arc Flash labels shall be furnished and installed on the appropriate equipment after the Short Circuit, Coordination and Arc Flash Study has been completed and approved. Layout and information on the label shall be approved by the engineer of record.

E. Once competed and approved, provide the Owner and Engineer an electronic copy of the full calculations, inputs and outputs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be grounded per the NEC.

B. Electrical distribution equipment shall have lugs/terminations suitable for the indicated conductor size. Where conductors have been oversized for voltage drop and where approved by the Engineer it shall be allowed to reduce the conductor size using hydraulically crimpled splice in a box next to the distribution equipment to allow for standard lug termination.

C. Install dry-type transformers with adequate clearances for proper ventilation. Bolt floor mounted transformer to pad.

D. Distribution switchboards, motor control centers and floor mounted dry-type transformers shall be mounted on 4 in. high concrete pads which shall extend 3 in. on all sides. Securely bolt the unit to the pads for proper horizontal and vertical alignment.

E. Coordinate transformer pad dimensions with transformer manufacturer's requirements. Coordinate transformer pad locations, dimensions and details with General Contractor.

F. Provide pad lockable branch circuit breaker device to hold circuit breaker in the closed position, but not prevent overcurrent protection, for all branch circuits serving fire alarm controls panels, emergency lighting and life safety branch circuits.

G. Identification:

1. Identify all items of equipment as described in Section 260501-3.1, Identification. Identification shall be provided for switchboards, panelboards, transformers, ASD's, motor starters, disconnect switches, enclosed circuit breakers, switchboard main/distribution breakers, MCC's automatic transfer switches, UPS's, generators, surge suppression devices, control panels, switchgear, etc.

2. Switchboards, panelboards, MCC's, switchgear, etc. shall have a label indicating name/tag ID, feeder source, conductor color convention and for service entrance locations the available short circuit current.

3.2 ELECTRICAL LOAD TEST

A. Conduct a load test prior to request for final payment and comply with the following:

1. Energize maximum normal light and power load for a period of two hours when scheduled.

2. Record voltage at service and at each panel.

3. Measure current in each phase of all feeders.

4. Adjust transformer taps as directed by engineer after review of report.

5. Provide and install all necessary metering equipment.

6. Owner's Representative or Site Representative shall witness the test.

7. Before final acceptance specified test shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such tests and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship.

Additional tests required by the Owner's Representative shall be provided at no additional cost. Protective equipment shall be actuated in a manner that clearly demonstrated their workability and operation.

3.3 CLEANING

A. At the completion of the project, while equipment is de-energized, it shall be thoroughly cleaned to a shipped condition using methods in accordance with the manufacturer's recommendations. Utilize vacuum for cleaning and not compressed gas.

3.4 SPARE PARTS

A. Deliver loose equipment to the Owner and obtain receipt for fuses, keys to panelboards, etc.

3.5 DISCONNECT DEVICES

A. All disconnect devices downstream of ASD's: Provide wiring, conduit and connections between ASD and disconnect auxiliary switch to ASD.

END OF SECTION

SECTION 262913 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation and full operation of separately enclosed, preassembled, motor controls, rated 600V and less.

1.2 DEFINITIONS

A. ASD: Adjustable speed drive motor controller.

B. CPT: Control power transformer.

C. DDC: Direct digital control. Building management/control system.

D. EMI: Electromagnetic interference.

E. PWM: Pulse width modulated.

F. RFI: Radio-frequency interference.

1.3 SUBMITTALS

A. Submit manufacturer's product data for each type and rating of motor controller indicated.

1. Include dimensions, weights, enclosure types, rating capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, mounting and attachment details, method of field assembly, components, and location / size of each field connection.

2. Include diagrams for power, signal, and control wiring.

B. As part of Operation and Maintenance Data, provide manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules, setting field-adjustable timers, controls, and status and alarm points, and setting field-adjustable overload relays.

1.4 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers.

Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with the manufacturer's recommendations, NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

D. Equipment and systems shall be NRTL tested and labeled.

1.5 WARRANTY

A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 with a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers include:

B. Adjustable Speed Drives (ASDs):

1. ABB (Design Make - ACH580)
2. Yaskawa
3. Eaton Corporation

C. Manual and Magnetic Motor Controllers:

1. Square-D - Design Make
2. Cutler Hammer
3. General Electric
4. Allen-Bradley

2.2 ADJUSTABLE SPEED DRIVE MOTOR CONTROLLER

A. General Requirements for ASDs:

1. ASD Description: adjustable speed drive, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; arranged to provide self-protection, motor protection, and variable-speed control of one or more induction motors by adjusting output voltage and frequency. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508. Suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1.

B. Unit Operating Requirements:

1. ASD shall provide full rated output from a line voltage of plus 10% and minus 10% of nominal voltage. ASD shall continue to operate without faulting from a +30% to -35% of nominal line voltage.

2. Input AC Voltage Unbalance: Not exceeding 5 percent.

3. Input Frequency Tolerance: Plus or minus 5 percent of ASD frequency rating.

4. Minimum Efficiency: 98 percent at 60 Hz, full load.

5. Minimum Primary-Side Power Factor: 98 percent under any load or speed condition.

6. Minimum Short-Circuit Current (Withstand) Rating: 100kA.

7. Ambient Operating Temperature Rating: 5 deg F (-15 deg C) to 104 deg F (40 deg C) minimum.

8. Humidity Rating: To 95 percent (noncondensing) minimum.

9. Altitude Rating: Suitable for intended location with 3300 feet minimum.

10. Vibration Withstand: Comply with NEMA ICS 61800-2.

11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.3 times the base load current for two seconds.

12. Starting Torque: Minimum 140 percent of rated torque from 3 to 60 Hz.

13. Output Carrier Frequency: Selectable; 1 to 12.5 kHz.

14. Stop Modes: Programmable including fast, free-wheel, and dc injection braking.

C. Inverter: ASD shall employ a 6 PWM power electronic system, consisting of:

1. Input Section:

a. ASD input power stage shall convert three-phase AC line power into a fixed DC voltage via a solid state full wave diode rectifier.

2. Intermediate Section:

a. DC bus as a supply to the ASD output Section shall maintain a fixed voltage with filtering and short circuit protection.

b. DC bus shall be interfaced with the ASD diagnostic logic circuit, for continuous monitoring and protection of the power components.

3. Output Section:

a. Insulated Gate Bipolar Transistors (IGBTs) shall convert DC bus voltage to variable frequency and voltage.

b. The ASD shall employ pulse width modulated output technology to power the motor.

D. Isolated Control Interface: ASDs control input to follow remote-control signal (selectable 0-10VDC, 4-20mA, 0-20mA, and network) over a minimum 40:1 speed range with electrical signal.

E. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.

2. Maximum Speed: 80 to 100 percent of maximum rpm.

3. Acceleration: 0.1 to 6000 seconds.

4. Deceleration: 0.1 to 6000 seconds.

5. Current Limit: 30 to minimum of 150 percent of maximum rating.

F. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the ASD, complying with UL 1449 SPD, Type 1 or Type 2.

2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

3. Under and overvoltage protection.

4. Inverter overcurrent protection.

5. ASD and Motor-Overload/Over temperature Protection: Microprocessor-based thermal protection system for monitoring ASDs and motor thermal characteristics, and for providing ASD over temperature and motor-overload alarm and trip. The settings shall be selectable utilizing the keypad.

6. Critical frequency rejection, with three selectable, adjustable dead bands.

7. Instantaneous line-to-line and line-to-ground overcurrent trips.

8. Loss-of-phase protection.

9. Reverse-phase protection.

10. Short-circuit protection.

11. Motor over-temperature fault.

12. Shut down on indication of motor local disconnect switch open position.

G. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts. Field adjustable for manual restart.

H. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

I. Bidirectional Autospeed Search: Capable of starting ASD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

L. Integral Input Disconnecting Means: magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

M. The ASD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.

N. The ASD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via keypad warning, Form-C relay output, or over serial communication bus.

O. Unit Mounted Operator Station: front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service. Coordinate the access codes with the Owner.

P. Status indicators displaying the following conditions:

1. Power on.

2. Run.

3. Overvoltage.

4. Line fault.

5. Overcurrent.

6. External fault.

Q. Indicating Devices: Digital display mounted flush in ASD door and connected to display ASD parameters including, but not limited to:

1. Output frequency (Hz).

2. Motor speed (rpm).

3. Motor status (running, stop, fault).

4. Motor current (amperes).

5. Motor torque (percent).

6. Fault or alarming status (code).

7. PID feedback signal (percent).

8. DC-link voltage (V dc).

9. Set point frequency (Hz).

10. Motor output voltage (V ac).

R. Control Signal Interfaces:

1. Electric Input Signal Interface:

   a. A minimum of two programmable analog inputs field selectable for 0- to 10-V dc or 4- to 20-mA dc.

   b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:

   a. 0- to 10-V dc.

   b. 4- to 20-mA dc.

   c. Potentiometer using up/down digital inputs.

   d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of one programmable analog output signal (0- to 10-V dc or 4- to 20-mA dc), which can be configured for any of the following:

   a. Output frequency (Hz).

   b. Output current (load).

   c. DC-link voltage (V dc).

   d. Motor torque (percent).

   e. Motor speed (rpm).

   f. Set point frequency (Hz).

   g. Any aux contacts.

4. Remote Indication Interface: A minimum of three programmable dry-circuit relay outputs (120-VAC, 1 A) for remote indication of the following:

   a. Motor running.

   b. Set point speed reached.

   c. Fault and warning indication (overtemperature or overcurrent).

S. Interface with DDC System for HVAC: Factory-installed hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports. ASD settings shall be retained within ASD's nonvolatile memory.

1. Provide EIA-485 port as standard. The standard protocols shall be BACnet MS/TP, Modbus RTU and N2. Provide additional ports for any other protocols that are utilized in the project.

T. Interface so ASD has indication of downstream disconnect switch(es) status (open-closed) and operates accordingly.

U. ASDs shall have an input inductive reactance either via 5% impedance AC line reactor or a pair of balanced DC chokes, one on the positive and one on the negative side of the DC bus, with an effective input impedance equivalent to a 5% AC line reactor. Any ASDs that do not meet this requirement must have a 5% AC line reactor added, with the reactor mounted in the same enclosure as the ASD.

V. EMI/RFI Filtering: Onboard filters shall allow ASD assembly to be CE marked; certify compliance with IEC 61800-3 for Category C2.

W. Additional Features:

1. Remote digital operator kit.

2. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

X. Accessories:

1. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in ASD enclosure cover unless otherwise indicated.

2. Reversible NC/NO bypass contactor auxiliary contact(s).

3. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

2.3 MOTOR STARTERS

A. Provide motor starters as listed on the Electric Equipment and Control Schedule on the drawings.

B. Starters, contactors and controllers shall comply with NEMA standards having general purpose NEMA 1 or 1B enclosure unless otherwise called for. Provide explosion proof, weather resistant or watertight construction as required. Starters shall be minimum NEMA size 0 with solid state overloads in each phase sized per NEC, motor full load amperage, service factor, and motor operating conditions.

C. Pad lock arrangements shall be provided to lock the disconnect device in the "off" position. Magnetic starters shall be provided with a control power transformer with 120V secondary and primary and secondary fusing and be sized to accept the loads imposed there on. Starters shall have LED type pilot lights. Each starter subject to electrical interlock and/or automatic control shall have necessary auxiliary contacts.

D. Auxiliary Devices: Provide pushbutton stations, pilot lights, devices, relays, transformers, selector switches, electric thermostats, auxiliary starter contacts as required for functions called for. Provide separate relay for each speed to operate electric dampers or other devices as required for multispeed motor circuit.

E. Manual Motor Starter:

1. Provide all starters with thermal overload(s); and pilot light(s) and handle lock-out provisions. Gang starter with selector switch for multispeed applications. Provide single or 2-pole as required:

a. 120 volt, single-pole, surface mounted: Square-D FG-5P and handle guard.

b. 120 volt, single-pole, flush mounted: Square-D FS-1P and handle guard.

c. 240 volt, two-pole, surface mounted: Square-D FG-6P and handle guard.

d. 240 volt, two-pole, flush mounted: Square-D FS-2P and handle guard.

e. 120 volt, single-pole, two speed, surface mounted: Square-D FG-11P and handle guards.

f. 120 volt, single-pole, two speed, flush mounted: Square-D FF-11P and handle guards.

g. 240 volt, two-pole, two-speed, surface mounted: Square-D FG-22P and handle guards.

h. 240 volt, two-pole, two-speed, flush mounted: Square-D FF-22P and handle guards.

i. 120 volt, single-pole, H-O-A selector, surface mounted: Square-D FG-71P and handle guard.

j. 120 volt, single-pole, H-O-A selector, flush mounted: Square-D FS-71P and handle guard.

k. 240 volt, two-pole, H-O-A selector, surface mounted: Square-D FG-72P and handle guard.

l. 240 volt, two-pole, H-O-A selector, flush mounted: Square-D FS-72P and handle guard.

m. 120 volt, single-pole, surface mounted, explosion proof: Square-D FR-1.

n. 240 volt, two-pole, surface mounted, explosion proof: Square-D FR-2.

F. Manual Motor Starter - Speed Controller: Shall be similar to "Manual Motor Starter," above, except two-gang with motor speed control sized to handle motor indicated, with positive full on and full off bypass of speed control unit.

G. Manual Starter with Relay: Shall be similar to "Manual Motor Starter," above, except to include a two-gang box with relay sized for load indicated, and hand-off-automatic switch. Connect relay for 120V operation on load side of starter in "automatic" mode. Coordinate connection of Form C maintained contact for control with Mechanical Contractor.

H. Magnetic Starter: Shall be single-speed, across-the-line type rated in accordance with NEMA standards, sizes and horsepower ratings. Starters shall be mounted in NEMA 1 enclosures unless otherwise indicated. Magnetic starters shall be equipped with fused control power transformer for 120V control power and double break silver alloy contacts; all contacts shall be replaceable without removing starter or disconnecting power wiring. Starter shall have straight-through wiring. Coils shall be of molded construction and shall be replaceable from the front without removing starter. Overload relays shall be solid state type with replaceable control circuit module. Thermal units shall be of one-piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed. Provide hand-off-auto selector switch and start-up pushbuttons and "run" pilot light in cover. Wire for maintained contact unless otherwise noted.

I. Combination Magnetic Starter: Shall be similar to "Magnetic Starter," above, except shall include fusible disconnect switch connected ahead of starter. The disconnect handle shall be in control of the disconnect device with the door open or closed. Disconnect handle shall be clearly marked as to whether the disconnect device is "on" or "off".

J. Combination Two-Speed Magnetic Starter: Shall be similar to "Combination Magnetic Starter", above, except with two starters, and six thermal overload units coordinated to match torque and horsepower characteristics of the motor. Starter shall be designed for variable torque operation, and shall be provided with high-low-off-auto selector switch and high and low pilot lights mounted in the cover. Wire for maintained contact unless otherwise noted.

K. Combination Reduced Voltage Magnetic Starter: Shall be similar to "Combination Magnetic Starter," above, except autotransformer closed transition reduced voltage type with autotransformer protection by winding over-temperature device.

L. Packaged Control Unit: Shall be furnished and mounted by others, and installed and connected by Electrical Contractor. This can consist of one or more starters, overloads and additional control devices prewired.

M. Contactor: Shall be similar to "Magnetic Starter", above, except without thermal overload units.

2.4 ENCLOSURES

A. Enclosures: NEMA 250, to comply with environmental conditions at installed location. Provide Type 1 for dry and clean indoor locations, Type 3R for outdoor locations, Type 4X stainless steel for kitchen and wash-down areas, and Type 12 for areas subject to dust, falling dirt, and dripping non corrosive liquids.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive motor controllers, with installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine motor controllers before installation. Reject motor controllers that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor controller installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted ASDs: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks.

B. Wall-Mounted Manual and Magnetic Controllers: Install on walls with tops at uniform height, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks.

C. Floor-Mounting Controllers: Install ASDs on 4-inch nominal thickness concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Roof-Mounting Controllers: Install ASD on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses, heaters in thermal-overload relays (based on actual nameplate full-load amperes) after motors are installed, and install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

I. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between ASDs and remote devices and facility's central-control system.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.

D. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.

E. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify motor controllers, components, and control wiring. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs. Label each ASD with engraved nameplate. Label each enclosure-mounted control and pilot device. Identify all items as described in Section 260501.

3.5 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections for ASDs:

1. Inspect ASDs, wiring, components, connections, and equipment installation.

2. Test insulation resistance for each ASD element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at ASD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager & Owner's Representative before starting the motor(s).

5. Test each motor for proper phase rotation.

6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Tests and Inspections for Manual and Magnetic Motor Controllers:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.

2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition, anchorage, alignment, and grounding, and that the controller is clean.

c. Inspect contactors: Verify mechanical operation and contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

d. Motor-Running Protection: Verify overload element rating is correct for its application and if protection is provided by fuses, verify correct fuse rating.

e. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

f. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

D. Motor controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the ASD and describes results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust carrier frequency for optimal operation with load and conditions.

D. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager & Owner's Representative before increasing settings.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain motor controllers.

END OF SECTION

SECTION 263213 - POWER GENERATION - AUTOMATIC TRANSFER SWITCHES AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of automatic transfer switches and related work required in these Contract Documents.

B. Include pre-test of entire generator system to show the system fully operates as intended for the owner prior to commencement of work. A final test after completion of work shall be performed to show the operation of all components installed as part of this projects works as intended and that the existing system components still operate the same as they did during the pre-test of the system. Contractor shall provide all fuel as required for testing of systems and shall note fuel level prior to pre-test of system and provide fuel level up to that point after completion of project and prior to turn over to owner.

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be accordance with NFPA 37 (Installation and Use of Stationary Combustible Engines), NFPA 70 (National Electrical Code), NFPA 110 (Standard for Emergency and Standby Power Systems), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards. If skintight enclosure is used, the equipment shall be listed for UL 2200.

D. System emissions shall meet or exceed the EPA and Code of Federal Regulations 40CFR.

1.3 SUBMITTALS

A. Submit shop drawings only for manufacturers named. Submission of other manufacturers will be rejected unless the terms of equivalents and substitutions stated in the General Provisions are followed.

B. Submit shop drawings on equipment and accessories to include the following:

1. Automatic transfer switch and accessories.

2. Wiring diagrams of all equipment, external and internal connections and interconnections.

3. Factory tests and field supervision reports as called for.

C. Composite Instruction Books shall include as a minimum the following:

1. Instructions covering overall equipment.

2. Instructions covering all major and serviceable components, and accessories.

3. Recommended spare parts with current prices.

4. Complete renewal parts information.

5. Quantities of oil/coolant/etc.

6. Instructions, both individually and collectively, shall adequately describe receipt, handling, care, inspection, installation, operation, and maintenance of equipment.

7. Instruction books shall be used for equipment installation and submitted prior to project closeout.

8. Factory trained maintenance provider contact information.

9. System error code (alarms, faults, etc.) list with descriptions.

1.4 STANDARDS AND TESTS

A. Equipment covered by these specifications shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of all applicable published ANSI, NEMA, and IEEE Standards, the requirements of NEC, NFPA 37, NFPA 110, UL 1008 and UL 2200 Standards. State and local requirements.

B. Furnish submittals of field test reports covering field tests and inspections performed and conducted by manufacturer's representative.

1.5 FIELD SUPERVISION

A. Submittal shall state that adequate local **(**within 75-mile radius of project locations**)** field supervision and service, by competent qualified representative of the manufacturer, who is regularly engaged in working on this type of equipment, will be available at any time.

B. Submittal shall state address of nearest vendor's place of business, telephone number and name of person to contact for field service.

C. Provide field supervision/service at no additional cost to cover inspection, test, and start-up of this equipment.

D. Submittal shall state the amount of field supervision/service recommended by vendor to cover critical points of installation, inspection, test, and start-up.

E. Provide proposal for a yearly maintenance agreement for time beyond the warranty period.

F. The above data shall be included with submittals.

1.6 RIGGING

A. Provide rigging to unload, move, transport, set in place, erect, etc.

1.7 WARRANTY

A. Provide a warranty for the specified equipment to be free from defects in materials and workmanship, whether functional or nonfunctional, replace or repair without cost, defects which, with normal usage, appear within one (1) year of project closeout.

1.8 TRAINING

A. Provide verbal and written training to facility appointed personnel in the proper and safe manner of operating equipment.

B. Training shall be at a time convenient for the Owner, not during system start up/testing and be a minimum of 4 hours or as needed for the Owner personnel to understand the system operation and maintenance.

1.9 DESCRIPTION OF SYSTEM OPERATION

A. Provide Automatic Transfer Switches to meet the following functions:

1. Arrange system for automatic starting upon failure of normal source voltage.

2. Provide programmable one-second time delay, field adjustable from 0 to 9999 seconds. Delay time between normal source failure and engine starting.

3. Initiate engine(s) starting cycle from transfer switch auxiliary dry contact.

4. Transfer critical and life safety loads from normal source power to emergency source when engine-generator reaches 90% of its rated voltage. Transfer equipment and nonessential loads after generator is 100% online.

5. Retransfer emergency loads from emergency generator to normal source ten (10) minutes after normal source has reached 90% or more of normal voltage. Control shall be field programmable from 0 to 9999 seconds.

6. Retransfer emergency loads from emergency generator to normal source instantaneously when normal source has reached 90% or more of normal voltage, if emergency generator has failed while supplying load.

7. Run engine for a period of ten (10) minutes after retransfer of emergency loads to normal source. Engine-generator**(s)** will then shut down, automatically resetting and leaving all controls ready for the next emergency start condition. Period shall be programmable from 0 to 9999 seconds.

8. Provide interconnection with the Facility building management system. Communication shall be directly to the BMS (contract with the BMS manufacturer) network system. Communication shall be network and provide indication of all unit control panel items.

9. Shall shutdown upon activation of remote emergency shutdown button.

PART 2 - PRODUCTS

A. Generator Auxiliary Equipment:

1. Provide generator output circuit breaker(s) as indicated, three pole, common trip, shunt trip, thermal magnetic type, to completely protect the generator from overloads; frame size and trip rating as called for. Provide solid state trip unit and 100% rating for circuit breakers 250A and above with long time, short time and instantaneous adjustable settings.

2.2 AUTOMATIC TRANSFER SWITCHES – OPEN TRANSITION (ATS)

A. Description:

1. The automatic transfer switch shall consist of a power transfer switch and a microprocessor based control module, interconnected to provide complete automatic operation. Double throw, mechanically and electrically interlocked. All main contacts shall be of silver composition. The operating transfer time shall be a maximum of 1/2 of a second. Transfer switch shall be capable of manual transfer in order to meet the requirements of UL 1008 and UL listing requirements as described UL's "Electrical Construction Materials.". Circuit breakers shall not be used as a switching means.

2. Operated by momentary energization of a single coil with mechanical latching in both normal and emergency positions.

3. Operating voltage for transfer obtained from source to which load is to be transferred.

4. Three phase, four wire, four pole, switched neutral 480V volt normal and emergency power source contacts.

5. Ampere rating as called for, rated for continuous duty.

6. Provide magnetic blowout coils and arc barriers on each pole.

7. Provide voltage supervisory relays on each phase of both normal and emergency sources, such that transfer and engine start is affected should any one phase of the three phase supply be below 80% of normal voltage.

8. Three-cycle closing and withstand rating minimum 35,000A rms symmetrical amperes without the use of current limiting fuses.

9. Provide compression type Burndy, long-barrel, Hy-dent, two-hole cable lugs for each power cable, phase and neutral. Cable size and conductor type as called for. Terminals front connected.

10. Manufacturer's standard mechanical type lugs suitable for aluminum or copper conductors. Provide lugs for each power cable, phase and neutral. Cable size and conductor type as called for. Terminals front connected.

11. Provide dual transfer switch operator with adjustable time delay 0-9999 seconds set at 3 seconds for a neutral position to allow motor loads residual voltage to decay between the time that the closed source is opened and the open source closed.

12. Provide pilot lights (LED's) as follows:

    a. Green, indicating normal switch position.

    b. Red, indicating emergency switch position.

    c. Fuse for each light.

13. Provide the following accessory features:

    a. Adjustable time delay before engine starting, field programmable from 0-9999 seconds. Factory set at 1s.

    b. Adjustable time delay on transfer to emergency, field programmable from 0-9999 seconds. Factory set at 3s. Field adjust ATS transfers to be staggered due to multiple ATS devices.

    c. Adjustable time delay on retransfer to normal field programmable from 0-9999 seconds, factory set at 300 seconds.

    d. After retransfer to normal, the engine generator set shall be allowed to run, unloaded, for an additional 0-9999 seconds, factory set to 300 seconds.

    e. Test switch, engine start and transfer.

    f. Pushbutton to bypass time delay on retransfer back to "normal" position.

    g. Engine start contact.

h. Auxiliary contacts to indicate normal, emergency and neutral position, two form C for each position. No common wires for auxiliary contacts. Bring wires to terminal block, suitably labeled.

i. A contact which closes when normal source fails for initiating engine starting, rated min, 10A @ 32 VDC.

j. A contact which closes when unit is on emergency power and normal power returns and is suitable for use. Contact shall be wired to elevator controller.

k. Provide ground studs to enclosure for Burndy, long-barrel, two-hole, Hy-dent cable lugs for size #4/0 copper cables.

l. Provide any other accessories as may be required to achieve operation as described in Article 1.9.

m. Provide minimum of 12 of spare fuses.

n. Provide NEMA 12 sheet metal enclosure for all mounting, front door hinged.

o. All time delay relays shall be field programmable and shall show the actual setting time in minutes or seconds.

p. Each automatic transfer switch shall have an input (powered and/or dry contact, coordinate with generator controls) to control switch to a neutral position (not connected to normal and emergency source) and shall remain in this position until the input is altered.

B. Acceptable Manufacturers:

1. Asco (dual operator). Design Make

2. Kohler.

3. Eaton.

2.3 POWER METER

A. For each transfer switch provide a factory installed unit mounted power meter with the following parameters:

1. LCD or LED display.

2. Line voltage control power.

3. Voltage input with overcurrent protection and disconnecting means.

4. True RMS voltage and current measurement.

5. Metered parameters: Phase current, line voltage, phase voltage, frequency, power factor per phase and three phase total, real power per phase and total, reactive power per phase and total, apparent power per phase and total, total real energy, total reactive energy, total apparent energy, voltage/current harmonics (% THD), user configured sliding window for real, reactive and apparent power peak demand. Sampling rate shall be 512 sample points per cycle minimum. Waveform capture with adjustable triggers.

6. Accuracy: Energy, and demand power: 0.2% in accordance with ANSI C12.20. Instrument current transformers shall be factory wired to shorting blocks to prevent open-circuiting the current transformers under energized conditions. The meter shall also be user programmable for current to any CT ratio.

7. Capable of metering up to 480 volts without external potential transformers. The meter shall also be user programmable for voltage range to any PT ratio.

8. System shall have building LAN connection for each and manufacturer software for monitoring the meter information to allow data storage instantaneous access and graphics for the Owner. All meters shall be connected to this software for a common information location. Software shall be provided to and loaded for the Owner without any yearly, update or licensing costs.

9. Communications: Modbus RTU, TC/IP, etc.

10. Acceptable Manufacturers:

    a. ABB Powermonitor 5000 - Design Make
    b. GE - KV Series
    c. Power Scout 3037

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. General Requirements:

1. Completely coordinate installation, assure that elements of the system are compatible, operational and correct.

2. Provide rigging to unload, move, and set/bolt in place ATS. Provide concrete pad as detailed on the drawings.

3. Provide miscellaneous bolts, washers, nuts, clips, lockwashers, small hardware, etc., of durium or equal rust resistant material, to make installation complete.

4. Refer to "Grounding" section of specifications.

5. Install equipment plumb, level, and true.

6. Leave maximum space available in front, along side, etc., all items of equipment, to allow easy access and servicing of serviceable components. Meet NEC requirements.

7. All floor mounted equipment shall have a 4" equipment pad with wire mesh reinforcement and doweled into the floor unless otherwise indicated.

8. Exterior units shall be a minimum of 5' away from the building or structure.

3.2 WIRING

A. Install power and control wiring between engine-generator set, transfer switches, battery charger, louvers, dampers, controls, and all other various and related equipment. Provide all necessary wiring and interface equipment to interconnect generator system with the Facility building management system.

B. Comply with Manufacturer's Instruction Books.

C. Color code and identify control and power wires and cables as called for.

D. Provide copper, 600 volt insulation minimum, control wiring; do not splice.

E. Generator start circuit shall be 2 hour rated type CI cable in conduit. This circuit shall be supervised and provide an alarm at the generator controller, remote annunciator panel and all other monitoring locations. Where there are multiple automatic transfer switches the start circuit shall homerun from each individual switch to the generator.

F. Provide "crimp-on" type terminal for control wire terminations, as called for.

G. Provide liquid-tight jacketed flexible conduit for all connections to engine, generator, and to day tank. All connections shall account for the anticipated vibration.

H. Provide green insulated grounding conductor in each conduit run.

3.3 PHASE IDENTIFICATION AND TESTING

A. Individual phase conductors shall be color coded as indicated in Section 260501 and the normal and emergency systems shall match.

B. Conductor phase shall be verified prior to applying/installing phase color indication.

C. Prior to operational testing of the system test phase rotation to ensure normal and emergency systems rotate in the same direction. This test shall be performed at each transfer switch. Provide a test report as part of the overall system testing report to indicate the following:

1. Date of test.

2. Personnel performing the testing.

3. For each transfer switch indicate switch designation, phase orientation (A, B, C) and rotation (clockwise, counter clockwise).

D. Include pre-test of entire generator system to show the system fully operates as intended for the owner prior to commencement of work. A final test after completion of work shall be performed to show the operation of all components installed as part of this projects works as intended and that the existing system components still operate the same as they did during the pre-test of the system. Contractor shall provide all fuel as required for testing of systems and shall note fuel level prior to pre-test of system and provide fuel level up to that point after completion of project and prior to turn over to owner.

3.4 IDENTIFICATION

A. For installations that have a single grounding location (connected to the main service entrance) provide signage indicating the following: "WARNING - SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE OR BONDING JUMPER IN THE EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE(S) IS ENERGIZED."

3.5 ELECTRICAL LOAD TEST

A. Conduct a resistive load bank test to the full capacity of the generator for four hours after completion of installation, but before connecting to the building system. Record system voltage, current, kW, pf, oil pressure and temperature every 15 minutes with the manufacturer recommended values in the test report. Upon successful completion of load bank test, complete connections to building system and perform an operational test as outlined in "B" below.

B. Conduct a full operational test of complete system prior to request for final payment and comply with the following:

1. Start the generator by simulating a loss of utility power at each transfer switch.

2. Energize maximum emergency light and power load for a period of one hour when scheduled.

3. Record voltage at generator and at each panel, using the same digital meter at each location.

4. Measure current in each phase of all feeders, using the same digital meter at each location.

5. Record the time from power loss to engine start and power transfer for each transfer unit.

6. Reconnect circuits in an effort to provide balanced (within 10%) load on all feeders.

7. Provide and install all necessary metering equipment.

8. Owner's Representative shall witness the test. This shall also include a representative from Cornell FM Operations.

9. Provide complete test report with the following as a minimum:

   a. Attendees

   b. Time/date

   c. Initial parameters

   d. Time delay on start.

   e. Cranking time until the generator starts.

   f. Time to reach rated frequency and voltage.

   g. Time for each automatic transfer switch to switch to emergency.

   h. Engine/generator parameters - oil pressure, temperature, voltage, current, kW, power factor, etc. for each 5 minutes.

   i. Automatic transfer switch retransfer time.

   j. Generator shut down time.

   k. Owner sign off.

10. Before final acceptance, specified tests shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such test and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Notify Engineer when load bank test is scheduled two (2) weeks prior to actual test.

C. Include pre-test of entire generator system to show the system fully operates as intended for the owner prior to commencement of work. A final test after completion of work shall be performed to show the operation of all components installed as part of this projects works as intended and that the existing system components still operate the same as they did during the pre-test of the system. Contractor shall provide all fuel as required for testing of systems and shall note fuel level prior to pre-test of system and provide fuel level up to that point after completion of project and prior to turn over to owner.

3.6 EQUIPMENT PROTECTION

A. Provide repair or replacement for all damage and defacement, whether functional or nonfunctional, to all equipment from the time it is unloaded, during installation, and during period of beneficial use, and until installation is accepted.

END OF SECTION

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Provide interior and exterior lighting systems, including luminaires, hangers, supports, fittings, wiring, connections and controls, as indicated in the Contract Documents for complete and operational systems. The lighting layouts on the drawings are diagrammatic only. Refer to architectural "Reflected Ceiling Plans" for exact location of interior luminaires. Luminaires, in general, have been specified for the particular type of ceiling in which they are to be installed. Verify the ceiling construction details and provide luminaires suitable for the respective ceiling types and room finish schedule.

1.3 REFERENCES

A. The following standards, criteria, codes, etc. shall be followed in the manufacture and installation of the lighting systems.

1. NFPA
2. NEC
3. IESNA
4. NEMA
5. ANSI
6. UL

1.4 ENERGY CONSERVATION WORK

A. Work installed as part of this Contract will be eligible for energy rebates/incentives available. The energy rebate shall be paid directly to the Owner. The Division 26 contractor shall cooperate with the Owner and the funding source to provide proof of purchase information, quantities involved, fill out forms, etc., to accommodate all required paperwork. Include all costs associated with this requirement.

1.5 QUALITY ASSURANCE

A. Luminaires shall be as specified in the "Luminaire Schedule". Luminaire types, appearance, characteristics, photometrics, finishes, etc., correspond to the specified manufacturer and associated series or catalog number listed in the "Luminaire Schedule". Products of other listed acceptable manufacturers shall be equivalent in every way to that of the luminaire specified. The Engineer reserves the right to disapprove any luminaire type submitted which they feel is not equal in quality, appearance or performance to the luminaire specified.

B. Manufacturer's luminaire series or catalog numbers listed in the "Luminaire Schedule" indicate quality, type, and style, but may not cover required special design details. Provide luminaires having such special details as noted in the "Luminaire Schedule", as indicated by the specified luminaire model number and as required for proper installation.

C. All luminaires shall be new and bear a Nationally Recognized Testing Laboratories (NRTL) label for the service intended.

D. Luminaires shall be products of manufacturers regularly engaged in the manufacture of the type of luminaires specified and shall be the manufacturer's latest standard design that complies with specification requirements.

E. Verify the availability of all luminaires proposed to be used in the execution of the work prior to submitting same for approval. The discontinuance of production of any luminaire after such approval has been granted shall not relieve the Contractor from furnishing an approved luminaire of comparable quality and design at no additional cost.

F. Photometric and operational data shall be provided only by qualified and certified organizations. Certification documentation shall be submitted with the luminaire information.

G. Should there be any difference between drawings and schedules, secure from Architect/Engineer such information as necessary prior to providing proposal. When finishes are not definitely specified, they shall be as selected by the Architect and not be limited to standard finishes.

H. Locations indicated for luminaires are approximate. Field coordinate exact locations as near as possible to the location indicated. Coordinate with the Engineer for any major location changes.

1.6 SUBMITTALS

A. Product Data: For each luminaire type, include in a single submittal, in order of luminaire designation, the catalog "cut" sheet with complete manufacturer and model number. Product data should include the following:

1. Manufacturer and Catalog Number.

2. Features, accessories, materials and finishes.

3. Physical description and dimensions of luminaires.

4. Life, power input, output (lumens, distribution, CCT, and CRI) and energy-efficiency data.

5. Photometric data and adjustment factors based on laboratory tests (space to mounting height ratio, coefficient of utilization complete values, IES distribution, candlepower distribution by angle and luminaire efficiency). Format shall be in accordance with IES TM-27.

6. Power, signal, and control wiring diagrams between luminaires and controllers.

7. Lens/Louver Type.

8. Driver with each type luminaire as applicable (type, sound rating, overload protection, voltage, input/fixture wattage, ballast factor, power factor, etc.).

9. Certification of IES LM-79, IES LM-80 and TM-21 testing for LED luminaires. Luminaires shall be tested in accordance with IES LM and TM standards.

10. Proof of Energy Star listing.

11. Warranty.

B. Coordination Drawings: Provide coordination drawings in accordance with Section 260500. Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structure members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including other luminaires, air outlets and inlets, speakers, sprinklers, access panels, ceiling mounted projectors, etc.
7. Coordination of ceiling types and ceiling grids/structure to account for luminaire mounting and space requirements and luminaire lengths.

C. Color Chips: Provide color chips of available finishes for luminaires upon request of Architect/Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Luminaires and equipment shall be delivered with NRTL and manufacturer's labels intact and legible. Broken, cracked and damaged materials and equipment shall be removed from the site immediately and be replaced with new materials and equipment. Luminaires and accessories shall be stored in protected dry locations in their original unbroken package or container. Luminaires shall be protected from dust and dampness both before and after installation. Luminaires shall be protected from paint and cleaning solvents during all phases of construction.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division hazard by a NRTL.

C. UL Compliance: Comply with UL 1598 and UL 8750.

D. Recessed Luminaires: Comply with NEMA LE 4.

2.2 LIGHT-EMITTING DIODE (LED) LUMINAIRES

A. Luminaires shall be identical in construction features, options and appearance to the luminaries specified in the Luminaire Schedule. LED luminaires include white and RGBW systems as indicated on the luminaire schedule.

B. Luminaires shall be provided with all cables, controllers, power supplies, drivers, connectors, terminators and accessories required for a complete installation. LED system shall utilize pulse width modulation, non-linear scaling techniques and reverse polarity protection.

C. Provide dimming down to 10% as a minimum, or to percentage indicated or called for on the drawings. Unless otherwise indicated, the dimming control shall be a 0-10VDC signal

D. RGBW LED systems where indicated shall be capable of at least 8-bit control of red, green, blue and white module. RGBW LED system shall be capable of setting each module with a unique and individual address. Each address shall be controlled independently by DMX or alternate method protocol. All RGB LED fixtures shall undergo a minimum of eight-hour burn-in testing during manufacturing.

E. LED luminaires shall be high brightness and binned for forward voltage, luminous flux and wavelength.

F. LED luminaires shall be tested in accordance with IESNA LM-79 (luminous output, power input, luminaire efficacy (lumens/watt), color temperature and color rendering index), IESNA LM-80 (L70, output luminous maintenance, 10,000 hour minimum test, calculation method is not acceptable) and IESNA TM-21/28. Luminaire output shall be a minimum of 100 lumens/watt. Rated life shall be a minimum of 50,000 hours at 70% output. Testing shall be performed by a US Department of Energy (DOE) accredited laboratory.

G. Drivers shall be solid state Class 1 power supply/driver with universal input (120-277V). The system shall have a minimum 90% power factor, 3.5 maximum crest factor, minimum efficiency of 90%, a maximum of 20% THD and overload protection. Adequate heat sink capability shall be provided to ensure the rated life. Unit shall meet FCC rules and regulations.

H. Where indicated luminaires shall have color tuning capability and control. System to have separate dimming (5-100%) and color (3000K to 5000K, or as indicated on drawings) adjustability. Control shall be Dali or DMX512 for controllability as indicated. The system shall utilize the most recent settings when energized.

I. The luminaire (to include LED sources and drivers) shall have a full five (5) year minimum warranty for replacement and labor.

1. Acceptable LED Manufacturers:

a. Philips
b. Osram
c. Cree
d. Nichea
e. Lumiled

J. LED Emergency Drivers:

1. LED emergency drivers shall have the following minimum requirements:

a. Operate indicated fixtures at full illumination for 90 minutes minimum.

b. Universal voltage input (120 to 277V).

c. Upon loss of normal power, fixtures shall automatically switch to battery power.

d. Upon restoration of normal power, fixture shall return to normal mode and charge battery.

e. Battery shall be maintenance free, nickel cadmium type with a minimum life expectancy of seven (7) years.

f. Driver shall be suitable for the environment installed.

g. Driver shall be Class 2 and enclosed entirely in the fixture (except for down lights and exterior locations).

h. Units shall be listed for UL924 -Emergency Lighting and Power Equipment.

i. Minimum five (5) year non-prorated full warranty.

j. Factory installed.

k. Shall include an emergency system test switch above ceiling adjacent to fixture.

l. Unit shall be self-testing and provide indication of unit failure.

m. Design Make: Iota, ILB-CP series or approved equal.

2.3 EXIT LUMINAIRES:

A. Electrical Characteristics:

1. LED type for 120/277 volt supply.

2. Meet or exceed illumination requirements of NFPA 101 and all of the requirements of UL924.

3. Maximum input power of 5 watts per illuminated face.

4. Provide Universal mount unit.

5. Provide single or double face and arrows as indicated on Contract Documents.

6. Acceptable Manufacturers:

a. Per Contract Documents luminaire schedule

2.4 EMERGENCY LIGHTING UNIT WITH BATTERY BACK-UP:

A. Completely self-contained in compact, low profile injection molded UL 94V-0 flame rated thermoplastic housing, damp location rated with universal mounting plate.

B. Premium grade, pure lead maintenance free battery with sufficient capacity to operate the light sources for 90 minute to an end voltage of 87-1/2% of nominal battery voltage. Three stage charger (constant current, equalize and float charge), relay, low voltage battery disconnect and brownout protection circuits.

C. Glare-free LED type lighting source. Test switch and charge rate indicator.

D. Universal 120/277 volt supply.

E. Photometric output: for a location with 8' unit mounting height, 9' ceiling, 8' wide corridor and 80/50/20% reflectance, multiple unit spacing shall be:

1. Standard unit - 30' on center.

2. High output (HO) unit - 60' on center.

F. Acceptable Manufacturers:

1. Standard unit: Dual-Lite EV Series (Design make)

2. High output unit: Dual-Lite EVHC Series (Design make).

3. Approved equal.

2.5 LUMINAIRE CONSTRUCTION

A. Metal Parts:

1. Free of burrs and sharp corners and edges.

2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

C. Lenses:

1. Shall be listed materials tested in accordance with ASTM D-635, "Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position" and burns less than 2/5 inches per minute.

2. The products shall have a smoke density of less than 75 when tested in accordance with ASTM D-2843, standard test method for "Density of Smoke from the Burning or Decomposition of Plastics".

3. The flame spread rating shall not exceed 0-25 and smoke developed rating shall not exceed 450 in accordance with ASTM E-84, standard test method for "Surface Burning Characteristics of Building Materials".

4. Self-ignition shall not occur below 600°F, in accordance with ASTM D-1929, standard test method for "Ignition Properties of Plastics".

5. Materials shall remain in place 15 minutes at 175°F and fall from frame at 200° below ignition temperature in accordance with ASTM D-648, "Deflection Temperature of Plastics Under Flexural Load".

2.6 LUMINAIRE SCHEDULE

A. Luminaire schedule is found on the contract drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

A. Comply with NECA NEIS (National Electrical Installation Standard) latest edition.

B. All luminaires shall be installed as per manufacturer furnished installation instructions.

C. Provide for every luminaire as shown on the plans, or as scheduled on the drawings.

D. Location of all ceiling and wall mounted luminaires shall be as indicated on the Architectural and Electrical drawings. The contractor shall verify ceiling type, construction, and material prior to ordering.

E. Provide luminaires with an IC rating for luminaires installed in direct contact with insulation.

F. Provide plaster frames for plaster ceilings and flanged frames for drywall ceilings.

G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

H. Luminaires shall be suitable and as recommended by the manufacturer for the actual intended mounting method and materials.

I. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and maintenance.

3. Provide support for luminaire without causing deflection of ceiling or wall.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

J. Flush-Mounted Luminaires:

1. Secured to outlet box.

2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.

3. Trim ring flush with finished surface.

K. Wall-Mounted Luminaires:

1. Attached to structural members in walls, to a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.

2. Do not attach luminaires directly to gypsum board.

L. Suspended Luminaires:

1. Pendant and Rods:

a. Pendant mount luminaires from 1/4 in. threaded rods of required length.

b. Sleeve threaded rods with 1/2 in. EMT painted with color as directed by Architect/Engineer.

c. Brace pendants and rods longer than 48 inches to limit swinging.

2. Aircraft Cable:

a. Cables shall be 1/16 in. aircraft cable with end safety fittings. Cable shall be provided with 2 in. diameter mini-canopy and threaded coupler for attachment to a 1/4 in.-20 threaded stud extending 3/4 in. below ceiling.

b. Cable assembly shall include a spring-loaded adjustment device mounted in the fixture.

c. The Contractor shall be responsible for providing required supports for cable attachment.

d. For cord feed to the luminaire provide continuous cord clip of matching color to attach the cord to the cable.

e. Support per manufacturer's recommendations.

3. Support stem mounted, single unit luminaires with approved outlet box and accessories that hold them and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

4. Use tubing or stem for wiring at one point of continuous rows of luminaires and tubing, rod, or wire support for suspension for each unit of length of luminaire chassis, including one at each end.

M. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.

2. Use approved devices and support components to connect luminaire to building structure in a minimum of four locations, spaced near corners of luminaire. Utilize #10 steel wire; similar to that used to support the ceiling grid.

3. Provide UL listed seismic hold-down clips and fasten to luminaires and to ceiling grid members at or near each luminaire corner.

4. Install luminaires of sizes less than ceiling grid as indicated on reflected ceiling plans or center in acoustical panel and support luminaire independently with at least two metal channels spanning and secured to ceiling tees.

5. Contractor to verify luminaire mounting and supports are compatible with the ceiling grid type and mounting/support requirements.

6. Contractor to coordinate recessed linear luminaire run lengths with the ceiling grid layout and required mains supports. All continuous run lengths to be verified and coordinated prior to determining the final housing lengths.

N. Cove Lighting:

1. Installed so as to produce a continuous and unbroken band of light with no shadows or light gaps.

O. Provide all necessary accessories for "end-to-end" mounting where continuous rows of luminaires are indicated. All luminaire assemblies shall be grounded.

P. Luminaires installed in continuous rows may be fed by a single outlet if luminaires are UL approved and suitable for through wiring in luminaire raceway.

Q. New luminaires may be provided to replace existing luminaires indicated to remain or be reused, subject to shop drawing approval.

3.3 REMOTE DRIVERS

A. Remote drivers shall be mounted in an approved NEMA 1 enclosure and shall be located in areas easily accessible to maintenance personnel.

B. Wiring from luminaire to remote driver shall not exceed the driver manufacturer's recommendations for distance.

C. Remote driver shall be clearly labeled indicating fixture served, voltage, panelboard and circuit number served from.

3.4 GROUNDING

A. Ground all non-current carrying parts of all lighting luminaires.

B. All grounding shall be accomplished with NRTL tested grounding connectors suitable for this purpose.

3.5 LABELING

A. Attach a self-adhesive red dot label, 1/2 in. in diameter, to all luminaires with an integral battery backup and/or those tied into an emergency generator. Labels shall be attached to these fixtures or to adjacent ceiling tiles so that they are readily discernible for testing and maintenance purposes.

3.6 FINAL CLEANING

A. Immediately prior to acceptance, damp clean diffusers, luminaire trim, reflectors, louvers, lens, and similar objects of all luminaires. Remove all dirt, corrosion, foreign material, finger marks, and blemishes. Replace all burned out LEDs and failed components.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test of Emergency Lighting: Under supervision of Engineer, interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

D. Replace luminaires damaged during shipment, construction, or installation.

3.8 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260936 "Lighting Controls."

3.9 ADJUSTING

A. Provide adjusting the direction of aim of luminaires to suit occupied conditions. Adjustment may be required during hours of darkness.

B. Final distribution shall be acceptable to the Owner and may take several attempts.

3.10 REMOVAL OF BALLASTS IN EXISTING LUMINAIRES

A. Assume ballasts contain PCB material unless labeled otherwise or test samples show materials are not PCB; submit a test report. Remove all ballasts from existing luminaires indicated on contract documents. Dispose of all ballasts which do not have non PCB labels in PCB containers and pay all costs to have containers taken to EPA approved incinerators and disposed of all EPA regulations. Follow all EPA regulations for transporting material.

If ballast has leaked in existing luminaires, remove material deposited in luminaire and dispose of those materials as indicated above. Provide documentation verifying disposal of PCB contaminated ballasts.

3.11 REMOVAL OF LAMPS IN EXISTING LUMINAIRES

A. The Contractor shall employ the service of a certified disposal/recycling service company to dispose of all removed fluorescent and/or HID lamps.
All disposal procedures shall be performed in accordance with EPA Requirements and Subtitle C for the disposal of mercury contaminated lamps.

END OF SECTION

SECTION 265500 - LIGHTING CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a complete lighting control system as indicated on the Contract Documents and as specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 QUALITY ASSURANCE

A. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers.

B. Installation shall be accordance with NFPA 70 (National Electrical Code), energy conservation codes, state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA and IEEE Standards.

D. All equipment shall NRTL tested.

E. All components and assemblies are to be factory pretested.

F. The controls provider must:

1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed similar systems, utilizing their standard products, for a minimum period of five (5) years.

3. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

4. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system.

If requested, must provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.

1.4 SUBMITTALS

A. Submit the following equipment, materials, and products including all components and accessories:

1. General Equipment

2. Vacancy/occupancy Sensors

3. Digital Lighting Control System

4. Lighting Control Panels

5. Emergency Lighting Control Devices

6. Wiring diagrams

7. Commissioning Plan

B. Submit the shop drawings and the product data specified below at the same time as a single submittal package.

C. Product Data: Provide equipment data sheets, specifications, wiring diagrams and installation instructions for all required system components.

D. Shop drawings shall include the following at a minimum:

1. Composite custom wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted). Wiring diagrams shall include all system components, including but not limited to: room controllers, digital switches, vacancy/occupancy sensors, photocells, isolated relays, digital I/O interfaces to conference room A/V systems, network interfaces, lighting control panels and associated components.

2. Scaled drawing for each area showing exact location of each room controller(s), digital switch(es), vacancy/occupancy sensor, daylight sensor, lighting control panel and other associated system components.

3. All system devices shall be located per the system manufacturers recommendations. All devices shall be suitable for the building configuration and intended operation.

1.5 SYSTEM DESCRIPTION

A. The lighting control system and/or components, as specified and indicated on the drawings to provide the intended and required control of the lighting systems.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT

A. Switches

1. Toggle/Snap

a. Unit shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, 90° rear plug in termination with pig tail, with nylon/polycarbonate toggle, self grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20.

b. Acceptable Manufacturers (for single pole units, provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model).

1) Hubbell HBL1221

2) P&S 20AC1

3) Leviton 1221-2

2. Low Voltage

a. Unit shall be button type switch that is configurable from one button to eight buttons using point-to-point low voltage wiring for control of single or multiple loads. Each button shall provide a momentary contact and all share a common return. The switch shall be totally passive and contain no active electronics or power supply. Operation is dependent upon a Class 2 connection to a compatible relay panel or other device that can react to a momentary contact signal.

b. Each button shall have an LED indicator light that can serve as a status indicator or as a locator light. The LED indicators shall be powered by a 24VDC source originating from the lighting control panel or other device. The button quantities shall be as indicated on the plan views.

c. Acceptable Manufacturer

1) Wattstopper LVSW series (Design Make)

2) Acuity Brands

3) Hubbell

4) Approved Equal per Cornell Standards.

3. All device colors shall match the surrounding devices and shall be selected by the Architect.

B. Lighting Dimmers

1. Provide lighting dimmer where indicated suitable for the type of luminaire for even continuous control. Unit shall be rated for the indicated connected load plus 25% minimum (even when ganged). Review luminaire schedule and plans for type and loading. Provide for three-way control as indicated.

2. Low voltage dimming shall be as recommended by the luminaire manufacturer for magnetic or solid state.

3. LED dimmers shall be as recommended by the luminaire manufacturer and be listed for use with the associated driver.

4. Device color shall match the other project devices.

5. Acceptable Manufacturers:

a. Lutron (Design Make)

b. Crestron

c. Acuity Brands

d. Leviton

e. Approved equal per Cornell Standards

C. Time Switches:

1. Digital Lighting Controller:

a. Photosensor and manual inputs, battery back-up.

b. Astronomic control with holiday, 7 day and 56 point scheduling.

c. 120/277V input/control, SPDT 20A output.

d. NEMA 3R corrosion resistant enclosure with clear cover.

e. Design Make: NSI-Tork DGLC200A.

2. Electromechanical Controllers:

a. DPST, 40A per pole: NSI-Tork 120V - 7002Z, 277V - 7202Z

b. 3PST, 40A per pole at 277 volt: NSI-Tork 7302Z.

c. Two-circuit lighting control center: NSI-Tork T-920L.

d. Three-circuit lighting control center: NSI-Tork T-903-L.

3. Digital Time Switch (for use with Lighting Contactor):

a. SPDT, 7-day with 14 set points.

b. Digital, AM/PM Clock with LCD display.

c. Battery backup to keep program in memory for approximately seven (7) days.

d. 120V Make: NSI-Tork EW120 or equal.

e. 277 Make: NSI-Tork EW120-3 or equal.

4. Time switches shall be provided with NEMA 1 general purpose, surface mount enclosures unless otherwise noted.

D. Elapsed Time Switches:

1. Mechanical spring wound timer, which requires no electricity to operate the timing mechanism. Device shall fit a standard 2-1/2 in. deep wall box. Switch contacts shall break current carrying contacts at the end of the timed cycle.

a. 0-30 Minutes: NSI-Tork A530M or equal.

b. 0-4 Hours: NSI-Tork A504HH or equal.

c. 0-12 Hours: NSI-Tork A512 or equal.

E. Digital Programmable Time Switch:

1. Programmable countdown time switch to automatically turn lighting or other loads off when the programmed on-time expires. 120VAC, 60Hz, neutral required with a 0-600W load rating suitable for incandescent, LED, fluorescent, magnetic low voltage, electronic low voltage and 1/6HP motor. Adjustable on-time from 5-55 minutes (5 minute increments) to 1-12 hours (15 minutes).

a. Wattstopper RT-100 (Design Make)

b. Acuity Brands

c. Hubbell

F. Photoelectric Controls:

1. Heavy Duty, 1/2 in. Conduit Mounting:

a. 120 volt, SPST, 2000 watt: Tork Model 2101.

b. 277 volt, SPST, 2000 watt: Tork Model 2104.

2. Combination Photoelectric Control and Contactor:

a. 120 volt, DPST, 3000 watt per pole: Tork Model 5403.

b. 277 volt, DPST, 3000 watt per pole: Tork Model 5404-3.

c. 208 volt, DPST, 3000 watt per pole: Tork Model 5404.

G. Lighting Contactors

1. Similar to magnetic motor starters without overloads. Refer to specification 262000.

2. Mechanically held, electrically operated with control as indicated.

3. NEMA 12 enclosure.

4. Supply with appropriate accessories to interface with 2-wire and 3-wire control devices as required by the Construction Documents.

5. 22,000 ampere withstand at 250V.

6. 30 ampere continuous current rating per pole at 600VAC.

7. Number of poles as indicated.

8. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

a. ASCO 918 Series.

b. Square D Class 8902

c. Eaton

d. GE

2.2 VACANCY/OCCUPANCY SENSORS

A. Vacancy/occupancy Sensors:

1. Vacancy/occupancy sensors shall comply with the following as a minimum:

a. Zero crossing switching operation (switch on/off only where sine wave is at zero volts) suitable for linear, non-linear and electronic/magnetic fluorescent ballasts for the loads indicated. Where the load to be controlled exceeds the sensor load rating provide a separate relay of adequate rating.

b. Failure of the unit shall be to the on/closed position or manual operation.

c. Motion sensitivity adjustment (dip switch or dial) and time delay adjustment (5 to 30 minutes minimum, dip switch or dial).

d. Line voltage input and switching. Field selectable for 120 or 277 VAC, 60 Hz.

e. UL listed and have a five (5) year manufacturer full replacement warranty.

f. Test mode feature to override the set time delay to allow adjusting of the sensitivity.

g. Sensor locations shall be adjusted during construction and at occupancy as recommended by the manufacturer for optimal sensing and operation.

h. Operation shall be field selectable with vacancy sensor being manual "on" with close switch/contact upon motion sensing and open after the set amount of time delay without motion or occupancy sensor being automatic on upon motion sensing.

i. Adjustable controls/settings shall only be accessible when the front cover is removed or from the back of the unit.

j. Unit color shall match the project devices except for the ceiling-mounted units which shall match the ceiling color. All color selections shall be by the Architect.

k. Ultrasonic sensing shall not be affected by air movement and shall operate at 32 kHz minimum (shall not interfere with hearing aids or other equipment).

l. Provide components as needed for the indicated control.

m. A factory-authorized representative shall coordinate and instruct the startup services of the sensors providing placement recommendations, connection guidance and startup supervision and adjustment.

2. Ceiling Mounted - Ultrasonic (Subscript "U"):

   a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize ultrasonic sensing.

   b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.

   c. Sensing shall be 360 degrees with a minimum operating area of:

      1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.

      2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.

   d. Corridor (Major Motion): 50 ft. x 16 ft.

   e. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.

   f. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.

   g. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

   h. The maximum depth shall be 1.5 in. below the ceiling/box.

   i. Acceptable Manufacturers:

      1) Wattstopper WT Series (Design Make)

      2) Hubbell

      3) Eaton

      4) Acuity Brands

3. Ceiling Mounted - PIR Technology (No Subscript):

   a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize PIR technology motion sensing.

   b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.

   c. Sensing shall be 360 degrees with a minimum operating area of:

      1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.

d. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.

e. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.

f. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

g. The maximum depth shall be 1.5 in. below the ceiling/box.

h. Acceptable Manufacturers:

1) Wattstopper CI-24 (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

B. Switch Pack:

1. Provide a minimum of one (1) switch pack for each ceiling-mounted vacancy/occupancy sensor. Provide additional units for multiple circuits (quantity to match the quantity of circuits).

2. Unit shall be plenum rated with line voltage side into a metallic box.

3. Low voltage power shall be suitable for a minimum of three (3) sensors. Multiple sensors shall be able to control a single switch pack.

4. Minimum switching capacity shall be 20A (all types of loads) at 120/277 VAC.

5. Shall have enough spare contacts provided at each sensor for HVAC system connection

2.3 DIGITAL LIGHTING CONTROL SYSTEM

A. General:

1. All associated system components shall be supplied from a single manufacturer and shall be compatible for communication as part of a digital lighting control network. All digital lighting controls shall be implemented without a broad digital lighting control network and without external communication. Separate rooms shall not be interconnected unless necessary to achieve the control outlined in the documents. Combining multiple manufactures system components to achieve the required system operation is not acceptable.

B. Vacancy/Occupancy Sensors:

1. Wall or ceiling mounted (to suit installation) dual technology digital (passive infrared and ultrasonic) occupancy sensor. Provide unit to accommodate the square-foot coverage requirements for each area controlled.

2. Sensors shall have adjustable settings and features as noted below. Sensor shall be adjusted through one of the following: graphic LCD display, push button or via software from handheld device.

   a. Sensitivity: 0-100% in 10% increments.

   b. Time Delay: 1-30 minutes in 1 minute increment. Time delay shall be set 30 minutes.

   c. Detection Technology: Dual technology activation and or re-activation. The sensor shall be capable of being set to either PIR & Ultrasonic, PIR Only or Ultrasonic Only as required by the space being controlled as recommended by the manufacturer.

   d. Test mode – Five second time delay

   e. Walk-through mode

   f. Selectable operating parameters shall include as a minimum Auto (Occupancy) / Manual (Vacancy) - ON, blink warning, and daylight enable/disable when photosensors/day-light sensors are included in the digital network.

3. Sensing shall be 360 degrees with a minimum operating area of:

   1) Ultrasonic: 25 ft. x 25 ft.

   2) Passive Infrared: 32 ft radial.

4. RJ-45 port(s) for connection to digital lighting control network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration device and control by remote personal controls.

6. Assignment of occupancy/vacancy sensor to a specific load within the room without wiring or special tools.

7. Manual override of controlled loads.

8. Multiple occupancy sensors shall be installed in a room if required by the size/configuration by connecting them to the open topology digital lighting control network. No additional configuration shall be required.

9. Provide wall or ceiling mounted sensors as indicated on the drawings. Final locations of all sensors shall be in accordance with the manufacturer's recommendations.

C. Digital Daylight Sensor:

1. Digital daylighting sensor shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.

   a. Closed loop sensors measure the ambient light in the space and shall control a single lighting zone.

2. Digital daylighting sensors shall include the following features:

   a. Sensor's internal photodiode shall only measure light waves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.

   b. Sensor light level range shall be from 1-6500 foot-candles (fc).

   c. Capability of ON/OFF, bi-level, tri-level switching or dimming, for each controlled zone, depending on the selection of load controller(s) and loads assigned to controller(s).

   d. For switching daylight harvesting, the daylight sensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.

   e. For dimming daylight harvesting, the daylight sensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.

   f. Daylight sensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

   g. Daylight sensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.

h. Integral infrared (IR) transceiver/sensor for configuration and adjustment using a handheld configuration device.

1) Configuration LED status light on device that blinks to indicate data transmission.

2) Status LED indicates test mode, override mode and load assigning.

i. Recessed switch on device to manually turn controlled load(s) ON and OFF.

j. RJ-45 port(s) for connection to digital lighting control network.

k. A choice of accessories to accommodate multiple mounting methods and building materials. Daylight sensors shall be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Unit mounting shall be suitable for the intended location.

l. Any load or group of loads in a room shall be assignable to a daylighting zone.

m. Each load within a daylighting zone shall be individually enabled or disabled for discrete control (load independence).

n. All digital parameter data programmed into a daylight sensors shall be retained in non-volatile memory within the daylight sensors itself. Memory shall have an expected life of no less than 10 years.

D. Digital Wall Controller

1. General - Digital controllers may consist of multiple configurations and devices including but not limited to digital switches, dimmers and scene controllers. The digital controllers shall provide the control intent indicated on the drawings and connected to the digital lighting control network. Individual device operation shall meet the features indicated below.

2. Digital Switch - low voltage momentary pushbutton switches to have 1, 2, 3, 4, 5 and 8 button configurations; colors to be white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. The color shall match the other devices and be coordinated with the Architect. Wall switches shall include the following features at a minimum:

a. Fully configurable and adjustable using a handheld configuration device.

b. Label each button and/or controller with custom silk screen labeling. Labeling identification shall be coordinated with the Owner for identification once the system has been configured.

c. Button covers shall be field replaceable. Button replacement may be completed without removing the switch from the wall.

d. Indicating LED on each switch that blinks to indicate data transmission.

e. Scene Status LED on each switch button with the following characteristics:

1) Bi-level LED that is field configurable.

2) LED status indicates power to switch

3) Bright status level indicates that load or scene is active

f. RJ-45 port(s) for connection to digital lighting control network.

g. Multiple digital wall switches shall be installed in a room by connecting them to the open lighting control network. No additional configuration shall be required to achieve multi-way switching.

h. The following switch attributes shall be changed or selected using a handheld configuration device:

1) Load and Scene button function reconfigured for individual buttons (from Load to Scene, and vice versa).

2) Individual button function may be configured to Toggle, On only or Off only.

3) Individual scenes may be locked to prevent unauthorized change.

4) Switch buttons may be assigned to any load on any room controller and are not load type dependent; each button may be assigned to multiple loads.

3. Digital Dimming Switch - shall have the same features as the digital switches. Dimming switches shall have a raise/lower buttons that include LEDs to indicate the load dimming level. Buttons shall be labeled "UP" and "DOWN". The dimmer shall provide full function dimming control in multi-way applications, such as 3-way, 4-way and beyond.

a. The following dimmer switch attributes shall be changed or selected using a handheld configuration device:

1) Fade Up and Fade Down times for individual scenes and loads adjustable from 0 seconds to 18 hours.

2) Ramp rate adjustable for each dimmer switch from 0 to 10 minutes.

4. Digital Scene Selector - shall have the same features as the digital switches. Scene selector switches shall have four programmable preset scene buttons and a separate master button to allow dimming raise/lower and all-on/all-off control of the individual scenes. The buttons shall have suitable labels.

E. Room Controllers

1. Room Controllers automatically assign the room loads to the connected devices in the space without the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall not have, dip switches, potentiometers or require special configuration. The Room Controllers shall provide on/off/dimming control and shall include the following features as a minimum:

   a. Replacement: Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

   b. Device status LEDs to indicate:

      1) Data transmission

      2) Device has power

      3) Status for each load

   c. Installation features:

      1) Standard junction box mounting

      2) Low voltage connections using standard RJ-45 patch cable

   d. UL 2043 plenum rated system.

   e. Manual override and LED indication for each load

   f. Dual voltage input (120/277VAC, 60 Hz).

   g. Maximum of 20A combined load per Room Controller. Each relay rated for the following at 120/277VAC, 60 Hz:

      1) 20A magnetic ballast or incandescent.

      2) 16A electronic ballast or LED driver (meet NEMA 410 ratings).

      3) 1/2 HP motor load.

   h. Zero cross circuitry switching for each load.

i. One, two or three relay configuration. Provide additional room controllers networked together to accommodate the quantity of zones indicated on the drawings and as indicated in the room sequence of operation.

j. Equipment shall be suitable for the operating conditions within the intended locations.

k. RJ-45 digital lighting control network ports with the ability to connect all required room control devices for communication to the digital lighting control network.

l. Class 2 output to digital lighting network room devices suitably sized to power the devices within the room.

m. One (1) 0-10VDC analog class 2 dimming control signal per channel for control of compatible dimming ballasts and LED drivers.

n. The following dimming attributes shall be capable of being changed or selected using a handheld configuration device:

1) Establish preset level for each load from 0-100%

2) Set high and low trim for each load

3) Fade time from 0 seconds to 18 hours.

4) Set controller for switched or dimmed applications

F. Handheld Configuration Tool

1. Provide a configuration tool to facilitate optional customization of digital lighting control system, and used to set up open loop daylighting sensors.
The handheld configuration tool shall either be a separate device using wireless infrared communications or be a downloadable application to a user's cell phone using wireless communications.

2. Features and functionality of the handheld wireless configuration tool shall include:

a. Two-way infrared (IR) communication with system devices within a range of approximately 30 feet.

b. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

c. Read, modify and send parameters for occupancy/vacancy sensors, daylighting sensors, room controllers and buttons on digital wall switches and network settings.

d. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

e. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting.

f. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

3. Provide a total of two (2) configuration tools or free access to the downloadable cell phone application. The units shall be turned over to the Owner to allow for future modifications to the digital lighting control system setup and programming.

G. Acceptable Manufacturers:

1. Wattstopper: Digital Lighting Management - DLM, (Design make).

2. Crestron Controls: GLPAC

3. Hubbell NX

2.4 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Relay

1. Emergency Lighting Relay – To be a UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit shall provide normal ON/OFF or dimmed and dimming control of emergency lighting to match the normal lighting.
Upon normal power failure the emergency lighting circuit shall close, forcing the emergency lighting ON until normal power is restored. Features to include:

a. 120/277VAC, 60 Hz, 20A LED driver or electronic ballast rating. The relay voltage ratings shall match the lighting branch circuits.

b. Push to test button. Final button locations shall be coordinated with the Owner.

c. Auxiliary dry contact control for remote test switch or fire alarm system interface operation.

d. Provide separate auxiliary shunt relay when used with dimming driver/ballast to automatically open the 0-10VDC dimming control signal to automatically for the emergency luminaires to 100% output.

2. Acceptable Manufacturer:

   a. Wattstopper - ELCU-200 (Design Make)

   b. Functional Devices - ESRN

   c. Acuity Brands

B. Emergency Lighting Bypass/Shunt Relay

1. Emergency Lighting Bypass/Shunt Relay - To be a UL 924 listed device that is suitable for shunting around wall/dimmer control switches in order to turn on emergency lighting when normal utility power is lost. Upon normal power failure, the relay coil is deactivated and the normally closed contact falls closed bypassing the lighting control switches or dimming controls to automatically turn the emergency lighting ON. Features to include:

   a. 120/277VAC, 60 Hz, 20A LED driver or electronic ballast rating. The relay voltage ratings shall match the lighting branch circuits.

   b. Provide SPDT or DPDT application based on the specified lighting control system and the relay manufacturer's requirements.

2. Acceptable Manufacturer:

   a. Functional Devices - ESR Series (Design Make)

   b. Iota

   c. Acuity Brands

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all required system components, interconnection wiring and branch circuit power connections as required by the lighting control system manufacturer to meet the intended sequence of operation and system performance requirements. All system wiring shall be in accordance with the system manufacturer's requirements at a minimum.

B. When using wire for connections other than the digital lighting control network (Category 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements. All Category 5e cabling and connectors shall be terminated and tested to meet the system manufacturer’s requirements. Category 5e cabling shall have a green thermoplastic jacket to easily identify from other building network cabling, building management system, or other low voltage systems cabling.

C. All line voltage wiring shall be installed in conduit. Terminations shall be done above accessible ceilings or within utility rooms and within a 4"x4" back box and have a suitable cover provided. Digital network devices (room controllers, isolated relays, plug load controllers, etc.) shall be mounted to a junction box and connected as recommended by the system manufacturer.

D. All low voltage control cabling shall be plenum rated. Cabling shall be installed in minimum 3/4" conduit in vertical runs in walls/partitions and inside mechanical/utility rooms. Provide suitable back box as required by the system manufacturer for the device being installed. Above accessible ceilings all control cabling shall be installed within separate J-hook supports located at 3' on center with the cabling neatly bundled. All cabling inside utility rooms without ceilings shall be installed in conduit.

3.2 SYSTEM PROGRAMMING

A. Upon completion of the installation, the system shall be programmed by the manufacturer's factory authorized representative who shall verify a complete fully functional system.

B. The system manufacturer shall include separate individual site visits scheduled to complete the system programming and perform the following functions:

1. Initial system startup/programming (time shall be suitable to setup all system devices). A minimum of two days shall be accounted for the system initial setup.

2. Coordination with the owner to develop preferred lighting control scenes, scene illumination levels, button operation and coordinate day lighting requirements prior to final system programming. Once verified with the owner all system components shall be fully programmed and setup.

3. Verification of the system operation (time shall be suitable to test and verify day lighting functions are operating properly). The manufacturer shall provide light meters for verification; time shall be as required for proper testing of the system.

4. The lighting control system manufacturer shall coordinate all room names and scheduling with the owner prior to final setup.

5. The presence of the system manufacturer's service technicians to assist the installing electrician in all of the above is a requirement of this project and proof of time expended shall be provided to the Owner's Representative.

3.3 SYSTEM COMMISSIONING

A. The electrical contractor shall provide both the Owner and the electrical engineer with a minimum of ten working days written notice of the system startup and configuration date.

B. Refer to the lighting control details that are part of the Construction Drawings for sequence of operation and commissioning requirements of the project lighting control scenarios.

C. All lighting control systems and components shall be commissioned to verify sensor location, time delay/sensitivity is properly set, auto-on/manual-on, override times, controls, day-lighting control, communications between control panels, and timeclock controls are operating as intended.

D. Calibrate all sensor time delays, sensitivity settings and properly aim to guarantee proper detection of occupants and energy savings.

1. Adjust time delay so that controlled area remains lighted for 15 minutes after occupant leaves area.

E. Exterior photocells shall be aimed per the manufacturer's installation instructions. Locate and aim to be facing to the north and avoid being blocked by the building architectural features.

F. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting set points.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)

G. Re-commissioning – After 60 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Engineer / Owner of re-commissioning activity.

3.4 SYSTEM TRAINING

A. The Contractor shall provide instruction to the Owner's Representative with regard to use and operation of the system. Obtain signed receipt from Owner's Representative that instruction has been given.

B. The lighting control system's manufacturer shall supply at least one (1) service technician after all systems have been tested and in full operation as described above to assist the installing electrician to demonstrate and instruct the Owner's Representative on the operation, programming and any uniqueness of the control system. Minimum time required for Owner instruction of the system is one (1) eight (8) hour session. Provide additional instruction and training to the owner to as required to verify the owner is comfortable with the system operation. Time of demonstration and instruction to be at Owner's convenience during normal working hours and shall be scheduled a minimum of ten working days prior.

3.5 WARRANTY

A. Provide a five year complete manufacturer’s warranty on all products to be free of manufacturers’ defects.

3.6 MAINTENANCE

A. Spare Parts:

1. Provide the following spare parts/components to be used for the owner's maintenance. The spare parts shall be fully tested for proper operation and turned over to the owner in the original boxes:

a. Digital Light Control System

1)	(3)	Ceiling mounted occupancy/vacancy sensors
2)	(1)	Digital daylight sensor
3)	(2)	Isolated relay interfaces
4)	(3)	Room controllers
5)	(2)	Digital switches
6)	(2)	Digital dimmers
7)	(1)	Scene Control Switch
8)		500' of spare cabling that meets the manufacturers wiring requirements.

END OF SECTION

SECTION 272100 - LOCAL AREA NETWORK SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment, services, etc. for a complete functional Local Area Network (LAN) and related work as required in the Contract Documents.

B. The systems to be provided shall be for a switched LAN environment. The system shall hereafter be referred to as the Data Network System.

C. Basic Intent:

1. Located throughout the building as shown on the drawings, are places where computers and associated equipment are intended to be placed and connected to the network for the purposes of utilizing common resources.

2. The telecommunications rooms for the data network in the building(s) are located as shown on the drawings.

3. Located in various other places are additional Telecommunication Rooms. It is intended that these be connected with the Main Telecommunication Room by a fiber optic cable backbone. From each of these locations, data cable is to be run to the data jacks where computer equipment is connected.

4. Patch panels shall be used as termination points for all fiber optic cabling. Provide backbone cabling between telecommunication rooms as indicated.

5. Patch panels shall be used as termination points for all data cables and the individual fiber cables in telecommunication rooms.

D. Description of System:

1. The system shall include the items listed below, as described herein and as indicated on the Contract Documents:

a. Data network shall be compatible with existing network configuration and characteristics.

b. Campus service to the building(s).

c. Building Main Distribution Frame (MDF) for service entrance and distribution.

d. Intermediate Distribution Frame (IDF) as indicated for cabling distribution.

e. Backbone wiring from entrance facility to the MDF and from MDF to the IDFs.

f. Complete raceway system (cable tray, J hooks, conduit) for cabling distribution as noted on Construction Drawings.

g. Grounding of all racks, raceway and equipment.

h. Power for the telecommunication rooms.

1.2 TELECOMMUNICATION ROOMS

A. Each telecommunication room shall be furnished with 3/4 in. plywood backboard, floor to ceiling on all walls, with the plywood backboard painted with two (2) coats of fire resistant paint (UL/ASTM Class A), all surfaces.

1. ANSI/TIA/EIA Telecommunications Building Wiring Standards.

2. IEEE Telecommunications Standards.

3. BICSI Methods Manuals.

4. NFPA 70: NEC

1.3 QUALITY ASSURANCE

A. Work shall be as specified herein and it shall be neat and orderly installation. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.

B. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

C. Installation shall be accordance with NFPA 70 (National Electrical Code), TIA/EIA, IEEE, IEC, state codes, local codes, and requirements of the Authority Having Jurisdiction.

D. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMAIEC, TIA/EIA and IEEE Standards.

E. Each item shall be NRTL tested and listed.

F. The system provider must:

1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years.

3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day; 365 days per year and staff must be adequate to respond within two (2) hours of an emergency call.

4. Maintain adequate spare parts inventory to provide both normal and emergency service.

5. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

6. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, must provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.

7. Provide all system programming to deliver a customized system to the Owner ready for use.

    a. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.

    b. System shall be reprogrammed three months after occupancy/system turn over to incorporate all Owner desired modifications.

8. Any system being extended or connected to an existing system shall be tested for full functionality prior to beginning work and at the completion.

G. Contractor Qualifications:

1. This Contractor shall be a certified installer for the proposed equipment/system manufacturer(s) and be BICSI certified ITS Installer 2, Copper and Optical Fiber and shall be certified to terminate indicated fiber connectors.

2. The cable installer shall provide documentation and references from three (3) similar installations installed within the previous two (2) years within a 60 mile radius.

3. Contractor shall be trained through the Panduit certification for horizontal cabling.

H. Installer Qualifications:

1. Cabling installer must have personnel certified by BICSI on staff.

2. Cabling installed shall be trained through the Panduit certification for horizontal cabling.

1.4 SUBMITTALS

A. Provide the following in a single clear and organized submittal. Package shall be submitted as specified in:

1. Manufacturers catalog sheets, specifications and installation instructions for all system components.

2. Detailed description of system operation.

3. Itemized list of all features and functions.

4. Dimensioned drawings of all system control cabinets and layouts for all equipment rooms.

5. Wiring diagrams showing typical connections for equipment.

6. Contractor certification and qualifications.

7. Riser diagrams showing all components, devices and interconnecting cable types.

8. List of three (3) installations of equivalent or larger systems that have been installed within the past two (2) years and have been operating satisfactorily for a minimum of one (1) year.

9. Warranty information.

10. System test reports.

11. Provide scaled elevation and plan drawings indicating walls, data racks, patch panels, wire management, cable trays, power strips, door swing, etc. for each cable closet/room.

1.5 SYSTEM DESCRIPTION

A. Provide a complete and fully operational state of the art Local Area Network (LAN) system as described herein and indicated on the contract documents. Include any and all interface equipment to supply a complete network with complete equipment connections necessary to form a complete "turnkey" network system as outlined in these specifications.

B. The complete system shall include, but is not limited to, the following:

1. Equipment Room build-out.
2. Telecommunications Room build-out.
3. Equipment cabinets and racks.
4. Patch panels and patch cables.
5. Wire management.
6. Horizontal cabling.
7. Fiber optic backbone cabling.

8. Modular jacks, backboxes and faceplates.
9. Terminations and testing.
10. Raceways, pathways, cable tray, sleeves, pull boxes.
11. Firestopping.
12. Training and system programming.

C. Owner shall provide the network electronics.

1.6 WARRANTY

A. All cable plant parts shall be warranted to the owner for a period of fifteen (15) years as a complete end-to-end system.

B. All network equipment shall be warranted to the owner for a period of one (1) year. Provide technical support at no charge to the customer for a period of one (1) year after system has been commissioned.

C. Make available an extended warranty to the customer.

D. Warranties shall commence upon final acceptance of the system.

E. Contractor to submit cable records to Panduit for warranty. Warranty shall be from Panduit and cover 25 years per Cornell University Division 270000 standards.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. Augmented Category 6A UTP Cable:

1. Initially, the manufacturer shall perform qualification tests on each cable. These tests shall be performed in accordance with the latest revision of ANSI/TIA/EIA 568-C.2 standard prior to shipment.

2. Date of Manufacture: Cable shall be a maximum of one (1) year old, from date of manufacture when installed.

3. Cable shall have a ripcord.

4. Cable shall be plenum rated, 4 pair, 100 OHM, 23 AWG.

5. Cable shall meet all requirements of FCC 68, the latest revision of the TIA/EIA 568B-C.2 and Addenda.

6. Cable shall have blue colored thermoplastic jacket with overall diameter not to exceed .215 in. x .240 in.

7. Pulling tension shall be rated for 25 pounds minimum.

8. Cable shall be able to withstand a minimum bend radius of 1.2 in. at -20ºC without insulation cracking.

9. Cable shall be color coded in accordance with the latest revision of the TIA/EIA T568B polarization sequence.

10. Cable shall not exceed maximum length of 90 meters.

11. Provide a printed report documenting testing based on ANSI/TIA 568-C.2 tested at 500 MHz. Testing parameters as follows:

    a. Less than 21.0 ohm per 100 m DC resistance.

    b. Return loss > 10.0 dB/100m at 500 MHz.

    c. Insertion loss < 43.8 dB/100m at 500 MHz.

    d. Near end cross talk (NEXT) > 26.7 dB at 500 MHz.

    e. Power Sum - near end cross talk (PS-NEXT) > 23.8 dB at 500 MHz.

    f. Attenuation to cross talk ration far end (ACRF) > 10.2 dB at 500 MHz.

    g. Power sum - attenuation to cross talk ratio (PS-ACRF) > 7.2 dB at 500 MZz.

    h. DC resistance unbalance between any two (2) conductors of any pair shall not exceed 3%.

    i. The capacitance unbalance of any pair to ground shall not exceed 65.6 pF per 100 meters.

    j. Delay < 490 ns at 100MHz.

    k. Delay skew < 44 ns at 100MHz.

    l. Cable shall be ANSI/TIA/EIA-568-C.2 augmented Category 6 (Cat 6A) compliant. The cable shall be tested and characterized by the manufacture to 500 MHz.

12. Acceptable Manufacturers:

    a. Panduit
    b. Prysmian / General Cable
    c. CommScope (Cornell Site-Specific)

B. Single Mode Fiber (Indoor/Outdoor):

1. Maximum Attenuation per KM:

a. 1310 nM- 0.5

b. 1550 nM - 0.5

2. 1310/1550 nM.

3. Shall be tight buffer, plenum rated, indoor-outdoor breakout style.

4. Core Type: Single Mode.

5. Core Diameter: 8.3 Microns.

6. Clad Diameter: 125 Microns.

7. Minimum bend radius shall be 20 times the diameter.

8. Strength members shall be FGE/Aramid yarn.

9. Shall meet requirements for plenum and vertical tray cable specifications of the NEC.

10. Provide number of fibers/cable as indicated in riser diagram on Drawings.

11. Shall have individual fiber tube colors per TIA/EIA-598 and an overall yellow jacket.

12. Acceptable Manufacturers:

a. Corning

2.2 PATCH PANELS

A. UTP Cable Patch Panels:

1. All panels should consist of a faceplate, mounting, hardware, isolation bushings, connector assemblies and labels for all ports.

2. Provide patch panels in each enclosure or rack to which the cable is to be terminated. Patch panels shall be of the type, performance and Category to match the cabling.

3. Patch panels shall be mounted in standard 19 in. racks/cabinets.

    a. Contractor shall provide Panduit CJ6X88TG for Cat 6A terminations 48-port patch panels having wiring configuration specified with insulation displacement connectors on the back and 8P8C universal modular jacks on the front. No substitutions allowed.

    b. Contractor shall provide quantity of patch panels to terminate all UTP cable. There shall be a minimum of 25% spare capacity for future installation.

4. Jacks shall be Panduit CJ6X88TG for Cat 6A terminations, T568A only. No substitutions allowed.

5. Panels shall have factory labels for each port.

6. All cables are to be terminated per EIA/TIA 568A standards and dressed in a neat workmanship way. Match the Owner's standard configuration.

7. Modular jacks shall be mounted on PC boards to offer low insertion and NEXT loss.

8. Provide grounding screw assembly with serrated head screw and manufacturer recommended connection to the associated rack.

9. Shall exceed EIA/TIA-568, UL1863 and FCC Part 68 performance specified.

10. Acceptable Manufacturers:

    a. Panduit CJ6X88TG for Cat 6A terminations.

B. Fiber Optic Patch Panels

1. Provide fiber optic rack mounted enclosure in where fiber optic cable is to be terminated.

2. Provide LC connector to match existing style panel base. Provide quantity of ports to terminate all strands of the fiber optic cable with additional 25% spare ports.

3. Shall mount in standard 19 in. rack and be constructed of 16 gauge steel and have gasketed openings and hinged door for easy access.

4. Provide wire management below and in rear of patch panel.

5. Patch panels to have modular ports with 12 minimum ports.

6. Acceptable Manufacturers:

    a. Corning

2.3 OUTLETS AND CONNECTORS

A. UTP Outlets/Connectors:

1. Physical Specifications:

a. Shall be 8 position connector compatible with the cable characteristics.

b. Shall be modular and snap-in to user configurable faceplates for future retrofits meeting durability requirements specified in the latest revision of the CEI/IEC standard.

c. Shall be IDC type suitable for eight 22-24 AWG wires with a gas-tight connection.

d. Each contact surface shall have at a minimum, copper alloy with 50 micro-inches gold over nickel and a minimum contact force of 100g.

e. Conductors shall be separated and aligned internally by jack comb.

f. Shall have easy to read 568A/B color scheme to prevent termination errors.

g. Wired in accordance with TIA/EIA polarization sequence specified in Patch Panel section of this specification.

h. Transmission characteristics shall meet the requirements for the UTP cabling specified.

i. Minimum durability shall be 1000 connecting cycles.

2. Acceptable Manufacturers:

a. Panduit

B. Fiber Optic single mode Outlets/Connectors

1. Physical Characteristics:

a. Shall be LC type with insertion release mechanism.

b. Shall terminate up to 125 micron fiber.

c. Shall meet dimensional criteria of the latest revision of ANSI/EIA/TIA.

d. Typical outlet box shall be sized to insure minimum bend radius and store 1 meter of two strand fiber cable.

2. Transmission Characteristics:

a. Maximum loss of 0.3 dB per pair.

3. Splicing shall be by pigtail fusion as opposed to unicam connections.

4. Acceptable Manufacturers:

a. Corning

2.4 COLOR CODING

A. Cable outer jacket shall follow the color coding scheme as follows. Jacket color shall be continuous. Patch cords shall match the cabling.

B. Copper Cable:

1. Data Communication:

a. Category 6A - Green (Preferred)

- Blue (if green is not available)

2. Voice Communication:

a. Category 6A - Green (Preferred)

- Blue (if green is not available)

3. Wireless Network - Green (Preferred)

- Blue (if green is not available)

C. Fiber Optic Cable:

1. Backbone Cabling:

a. Single Mode - Yellow

2. Horizontal Cabling:

a. Single Mode - Yellow

2.5 DISTRIBUTION ENCLOSURES/RACKS

A. All enclosure/racks shall be properly sized and of the proper quantity to house all of the required components and 25% spare space capacity. Provide grounding stud for each vertical rack.

B. Label each rack/enclosure designating it per the latest TIA/EIA standard:

1. Adhered plastic electronic printed label with 1/2" high lettering minimum.

2. Mount to top and bottom of each rack/enclosure.

C. Enclosed, Floor Mounted Cabinet:

1. Steel framed, smoked Plexiglas door with lock (keyed to the Owners standard), full length piano hinge and field adjustable swing.

2. Steel Rear Door with Lock (lower half vented).

3. Two (2) eight position vertical mounted power strips.

4. Fan Assembly - Suitable top mounted fans (two minimum) for an ambient temperature of 85°F.

5. Wire management brackets.

6. Adjustable front and rear mounting rails.

7. Adjustable 19 in. wide mounting rails. Depth to accommodate the intended equipment (32 in. minimum).

8. Color black.

9. Verify swing of door in the field prior to ordering.

10. Unit width shall accommodate racking, power strips and cable management.

11. In locations requiring two or more enclosures, side panels shall be removed and cabinets shall be bolted together allowing access between cabinets.

D. Open, Floor Mounted Racks:

1. Nominal size shall be 19 in. wide x 7 ft. high x 20 in. (minimum) deep. Rated for 2000 lb. minimum. Depth to match the intended equipment.

2. Rack shall be constructed of 6061-T6 aluminum extrusion, with EIA = 3 in. x 1.265 in. channel, 1/4 in. thick flange.

3. Provide base angles and top cross bars.

4. The back of rack shall have wire management panels and cable tray to wall.

5. Rack shall have baked enamel finish.

E. Enclosed, Wall Mounted Cabinet:

1. Standard 19 in. wide, 24 in. deep cabinet.

2. Height as required.

3. 16 gauge cold rolled steel.

4. Rack shall have locking front door.

5. Ventilated side panels.

6. Two (2) six position power strips.

7. Rack construction shall match freestanding.

8. Racks shall have dual piano hinges to allow access to front and rear.

9. Provide vertical and horizontal wire management.

10. Verify swing of door in field prior to ordering.

F. Floor Mounted Server Racks (Four Post Racks):

1. Racks shall have four vertical posts with top/bottom framing and be as specified above for open, floor mounted racks.

2. Racks shall be provided where shown on the drawings or identified in the equipment schedule.

G. Equipment Shelves:

1. Provide quantity of equipment shelves as indicated.

2. Shelves shall be made of .09 in. aluminum and shall support up to 30 lbs. on each side. All mounting hardware shall have baked enamel finish.

H. Acceptable Manufacturers:

1. Chatsworth
2. Mid-Atlantic
3. Great Lakes

2.6 CABLE MANAGEMENT

A. All racks are to be provided with cable management hardware to insure a neat, functional system when complete. Racks shall as a minimum, include the following:

1. PVC construction; duct fingers to manage cabling; color to match enclosure.

B. All racks shall have 8 in. wide vertical full height cable management, including cover, front and rear, on both sides of the rack.

C. All racks shall have 2RU space horizontal full width cable management, front and rear, above and below each patch panel and piece of equipment.

D. Cabinets shall have 1RU space horizontal panels, front and rear, above and below each patch panel and piece of equipment.

E. All data distribution frame plywood backboards shall be provided with vertical and horizontal wire management with capacities to house all possible future cabling and patch cords for a neat and orderly installation.

F. Acceptable manufacturers:

1. Panduit

2.7 INNERDUCT

A. Innerduct shall be corrugated HDPE material, plenum rated, flexible, continuous, UV rated with flame/smoke spread in accordance with code and length markings on the outer surface.

B. When in conduit minimum size shall be 3/4 in., otherwise 1 1/2 in. minimum.

C. Acceptable manufacturers:

1. Carlon
2. Maxcell
3. Opti-Com

2.8 LABELING

A. General:

1. Labeling system and structure shall match the Owners existing. System shall provide as built final conditions for each cable, port, panel, rack, etc. and utilize MS Excel or approved equal documentation. Provide hard and electronic copy of labeling documentation to the Owner as part of the O and M process.

2. Each label shall contain the Telecommunication Room designated, the room number and the port number in the room. Verify color of label and size of font prior to completion. Provide samples as requested.

3. Labels shall correspond to the room/names/numbers upon completion of the project. Contractor shall not necessarily utilize existing room/names/numbers or those indicated on the blueprints.

4. Label each rack and patch panel with 1 in. high lettering, black on white, adhered electronically printed plastic type label with labels at top, bottom, front and back.

5. Firestop used in vertical riser and horizontal conduit sleeves penetrating ceilings and floors shall be labeled. Provide and install labeling at each penetration including penetration type with UL listing used, material used, date of install, and name of installer.

6. All cables shall be labeled per InfoComm' s Standard "F501.01:2015 Cable Labeling for Audiovisual Systems". These labels shall match the labeling on the system as-built drawings.

7. All AV connection plate jacks shall be labeled with engraving or printed labels.

8. Cables pulled for future use shall be labeled as such.

B. Patch Panel

1. Individually label all patch panel ports. Port numbers shall match opposite end outlet/port number.

C. Outlets

1. Individually label all patch panel ports. Labels shall be installed in a workman-like manner and fit completely in the recessed area of the labeled location.

2. Contractor shall utilize adhered labels at poke-thru locations and any other locations that do not have a label location.

D. Cable

1. Fiber Optic:

a. Individually label fiber optic cables at each termination point indicating building, destination room, rack number, panel number, port number, strand number and strand color.

b. Each strand color shall match a specific fiber termination number in each closet, i.e. blue - fiber 1, orange - fiber 2, green - fiber 3, etc.

c. Cable label shall be adhered electronically printed plastic type with cable designation fully visible.

2. Copper

a. Specifically label cables at each termination point indicating the building, destination room, rack number, panel number and port number.

2.9 UTP CABLE TESTER

A. Contractor shall utilize Fluke DSX 5000 tester or approved equal. Provide adapters for specified cables. Turn over to owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable:

1. Provide a minimum of one horizontal UTP cable to each communication outlet jack from respective equipment/telecommunications room patch panel as called for. Quantity of data jacks equals minimum quantity of UTP cables (typical).

2. Provide a minimum of one (1) pair (2 strands) of single-mode fiber optic cable to each fiber jack from respective equipment/telecommunications room as called for. Quantity of fiber jacks equals minimum quantity of 2 strand cables (typical).

3. All risers, and wiring concealed in walls or soffits, shall be installed in metal conduits.

4. All cable above accessible ceilings shall be installed in cable tray or J-hook style cable rings 3 ft. O.C.

5. Provide wire management and Velcro cable wraps every 24 in. throughout closets.

6. Wiring/cabling shall be installed in accordance with the manufacturer's recommendations. If the manufacturer recommends larger wire sizes, they shall be provided. However, smaller sizes or lower cable categories are not acceptable.

7. All Contract Documents are schematic. The system supplier shall incorporate their wiring requirements on the system drawings. The Contractor in conjunction with the system manufacturer shall be responsible for complete wiring requirements and conduit sizes.

8. Install UTP cable in accordance with latest revision of TIA/EIA 568 standards.

9. The Contractor shall be responsible for replacing all cables that do not pass required bandwidth and throughput tests.

10. All raceways and closets shall be installed in accordance with latest revision of TIA/EIA-569.

11. All cables shall be labeled in accordance with latest revision of TIA/EIA 606 and these specifications.

12. All horizontal cables shall be terminated in patch panels at the distribution frames, and at the UTP jack at the telecommunications outlet.

13. Maximum length shall be 90 meters.

B. Terminations:

1. All terminations shall be made by a manufacturer's trained representative.

2. Use termination kits for fiber and UTP that are approved by the manufacturer of the cable.

3. All backbone cable shall be terminated in a patch panel and all connections between horizontal and backbone cables shall be through cross connect cable.

C. Equipment and Devices:

1. Install all devices where shown on drawings. Provide all necessary conduit outlet boxes, junction boxes, supports, etc. Verify all required box sizes with the system supplier and coordinate with bending radius needs. All devices shall be modular for future moves and changes.

2. Install all equipment in specified 19 in. racks/cabinets leaving minimum 30 in. of access space on sides and back of rack and 36 in. in front of rack.

3. Provide all power outlets and plug strips required for system operation but not shown on plans.

D. Raceways:

1. Minimum size raceway shall be 1 in.

2. Minimum backbox size for telecommunications outlet locations shall be two-gang with raised cover; no single-gang boxes allowed.

3. Provide no greater than 180° in bends or 100 linear feet without pull box in any raceway.

4. No flexible conduit raceways allowed unless explicitly approved by CIT.

E. Data Network Ground System:

1. Provide grounding system for all equipment rooms and telecommunication rooms as called for in Specification Section 260526.

F. Telecommunications Rooms:

1. Provide 3/4 in. x 4 ft. high continuous plywood backboard with two (2) coats of medium gray fireproof paint in telecommunications rooms.

2. Coordinate with other trades to avoid services being installed above telecommunications racks.

3.2 TESTING

A. Copper Cable: System supplier shall channel test end-to-end each permanent link connection using latest 500 MHz for Cat 6A 1000 Mbps IEEE testing procedure. Tester must conform to the latest standards at the time of testing not time of bid and be Fluke DTX-5000 with latest software version, or approved equal. Testing shall be performed by a technician trained with the specific testing equipment.

B. Fiber Optic Cable: Provide an OTDR test for all fiber optic cable and connections per latest IEEE and ANSI accepted procedures. Test shall utilize Fluke Opti Fiber Pro OTDR.

C. Replace any cables and connectors that do not meet or exceed standards referenced and stated herein and then tested. Testing shall be end-to-end / port-to-port for each cable.

D. Test equipment shall be in good condition and working order, calibrated within one year of its use and utilize leads without twisting and kinks. Unit calibration shall be in accordance with Level III Field Tester per ANSI/TIA 1152.

E. A representative of the end-user will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing at no additional cost. Cables and connectors that do not pass shall be replaced and retested until acceptable results are obtained.

F. Test Reporting:

1. The field testing shall be accurately documented for submission, inclusion in O&M Manuals and for Owner future use.

2. Test reports shall include data directory table cross-referencing room numbers and cable numbers with the test report. Post copies of directory at telecommunications room location.

3. Report shall utilize electronic Windows based documenting with a hard and electronic copy provided to the Owner.

4. The report documentation for each cable test shall include the following as a minimum:

a. Project name.

b. Test equipment manufacturer and model number, and last calibration date.

c. Date and time of the test.

d. Patch panel identification.

e. Cable identification.

f. Cable type.

g. Pass/Fail: Pass indicating meeting or exceeding the identified criteria or standard (whichever more stringent) for all parameters. Fail indicating test not meeting identified criteria for one or more parameters.

h. Test pass criteria.

i. Cable length.

j. Propagation delay and attainable bandwidth.

k. List of tested parameters with test and allowable values. Any failed parameters shall be noted or highlighted.

5. Test reports shall be submitted to Panduit for the horizontal cabling warranty.

3.3 TRAINING AND INSTRUCTION

A. Provide brief overview of system of instruction to Owner personnel regarding system set up configuration and management. Training shall be sufficient for the Owner to understand the system operation, components, configuration, functions, testing and troubleshooting. All Owner questions shall be answered.

B. Training agenda (estimated duration, intent, specifications to be covered) shall be submitted for approval prior to the training. A finalized agenda shall be issued to the Owner and construction representative one (1) week minimum prior to the scheduled training. Owner's comments shall be incorporated and agenda redistributed prior to the training.

C. Two (2) hard copies and one (1) electronic (pdf) copy of the training materials shall be provided.

D. Provide updated cable schedule and redline/as-built during training and instruction period 2-3 weeks prior to occupancy.

3.4 WARRANTY

A. All cable plant parts shall be warranted to the owner for a period of fifteen (15) years as a complete end-to-end system.

B. All network equipment shall be warranted to the owner for a period of one (1) year. Provide technical support at no charge to the customer for a period of one (1) year after system has been commissioned.

C. Make available an extended warranty to the customer.

D. Warranties shall commence upon final acceptance of the system.

END OF SECTION

SECTION 274000 - AUDIO-VIDEO COMMUNICATION

PART 1 - GENERAL

1.01 PROFESSIONAL STANDARDS

A. The contractor is expected to install all work to the appropriate industry professional standards, manufacturer recommendations, and current applicable codes. If any work required exceeds the skills of the contractor they will employ appropriate subcontractors for the scope required.

B. The acceptability of materials and workmanship will be determined by the Architect, Consultant, and CM.

C. Any work that might be damaged, be inadvertently painted, or become dirty during construction will be protected by the contractor. All responsibility for protection shall be by the contractor. The contractor will provide final cleaning and or repair of all equipment in their scope to like new condition.

D. The contractor will attend and/or arrange meetings as required to make sure their scope is coordinated with all other trades. The contractor is responsible to make known to all other trades critically dimensioned items and locations to avoid conflicts. Where conflicts occur follow required procedures in the project manual to seek resolution.

E. Where any substandard work is provided by related trades that impedes the work of the contractor they will notify the CM, Consultant, Architect, or Engineer in writing as called for one the project manila to rectify the issue.

F. Where work is provided by others the contractor is responsible to verify installation conditions that relate to their work. If installation of related work is substandard the contractor shall generate a written RFI through proper channels based upon the project manual. The contractor shall not install their work to any substandard devices, etc. provided by others until such work has been resolved or until the contractor has received written authorization from the construction manager to proceed. If the contractor ignores substandard installation work by others and proceeds to install his devices to these items, then they accept and bear sole responsibility to repair, reinstall and correct any found deficiencies to the satisfaction of the owner upon final inspections.

G. The contractor will comply with the AHJ (Authority having jurisdiction) as it relates to programming any and all emergency interfaces.

H. The contractor is expected to possess knowledge of the equipment of their industry and provide all required small items required install specified equipment. Provide small Items such as rack rails, din rails, power cords, connectors, wall wart power supplies, crimps, Nicopress, and other items that may not be called out on drawings or in specs as required to support primary equipment.

I. When in doubt about any aspect of the work the contractor should not proceed until they obtain clarification from the appropriate entity following procedures detailed in the project manual.

1.02 DEFINITIONS

Code Requirements	Minimum requirements as specified by all applicable and published codes.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Diagrammatic	A diagram, paragraph, note or drawing serving to explain general intents and requirements (not necessarily an exact representation).
Devices	Any piece of gear, equipment, indicated component and any misc. related items required to implement and install a fully functioning system.
Equal or Equivalent	Equally acceptable as determined by Owner's Representative.
ETR	Existing to remain.
Extend	To increase the length(s) of any indicated conduit/wiring, etc. so as to reach a particular specified or implied point – including the provision of any misc. additional equipment as required for proper extension and to maintain full system functionality.
Final Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
Furnish	Supply and deliver to installation location to the appropriate trade responsible for installation.
Furnished by Others	Receive delivery at job site or where called for and install.
Inspection	Visual observations by Owner's site Representative
Install	Mount and connect equipment and associated items and make ready for use.

Labeled	Refers to classification by a standards agency.
Or Approved Equal	Approved equal or equivalent as determined by Owner's Representative.
Owner's Representative	The Prime Professional, Construction Management or Clerk of the Works.
Patching	Repair of holes, marks, and damage left from removals. Consult project manual for requirements.
Provide	Procure all required materials, labor, coordination and equipment and locate, install, connect and test ready for use.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
Replace	Remove and provide new item.
Remove	Safely Disconnect including any and all wiring, hardware, conduit (except concealed), anchors, suspension hardware etc. Legally dispose of items not called out to be offered to or returned to owner.
Review	A general contractual conformance check of specified products.
Satisfactory	As specified in contract documents.
Shall	Indicates that the contractor must perform work and provide devices as indicated. This is a mandatory, obligatory, contractual requirement and is not optional in any way.
VIF	Verify in field.

Refer to General Conditions of the Contract for additional definitions.

1.03 INTENT OF DRAWINGS:

A. Throughout the contract documents there are various manufacturers and products referenced. It is understood that these products establish a basis of design that all other "or equal" Equivalents must meet or exceed. All submitted devices must be the referenced product or approved equal.

B. The drawings in this package are diagrammatic in nature, unless detailed dimensioned drawings are included. The drawings show the approximate locations of equipment and devices. The final and exact locations of all non-dimensioned devices are subject to the approval of the Owner or the Owner's Representative. Devices with detailed installation dimensions; however, are critically located and must be installed as closely to those indicated dimensions as is possible, unless alternate instructions have been given to the contractor in writing by the consultant (or unless building conditions dictate that dimensions be altered). Any altered installation dimensions must be cleared, in writing, by the consultant prior to installation.

C. The contractor(s) shall inspect the entire building(s) with the Owner’s representative prior to beginning any work and shall identify the exact locations and installation methods for all devices, conduit and wiring prior to beginning work.

D. Typical details are shown for the installation of various devices. The details do not apply to all situations. Installation methods for all work shall be subject to the Owners and construction manager’s approval. Provide all work and equipment required for a professional, workmanlike installation.

1.04 SECTION INCLUDES BUT IS NOT LIMITED TO:

A. Provision of audio and AV system and related work scope as indicated on drawings.

B. Wiring, Set up, and commissioning.

C. Training and closeout documents.

1.05 RELATED SECTIONS & DOCUMENTS:

A. The contractors shall examine the full set of construction drawings and specifications and ascertain all aspects of the scope of work described within this specification. The contractor will be responsible for cooperation with and adherence to the overall scope and intent of the project relative to the work being done by the contractor.

B. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 0, 1, and 16 specification sections apply to work of this section (related specification sections may vary depending upon the particular CSI format being adhered to). All related drawings, contract conditions and general requirements found in the project manual that apply to the general contract will apply to the work described in this specification. Examine all referenced documents for general project requirements relating to the work in this specification. Contact the architects, engineers and/or construction manager for any clarification required to properly bid this project. It is the contractor’s responsibility to obtain necessary clarification

before bidding. No change orders will be allowed for existing project conditions and contractor requirements not properly investigated by the contractor.

1.06 RELATED WORK NOT INCLUDED:

A. The contractor is responsible for all work on the T series drawings and written specifications. Specific coordinated work is to be provided by the electrical contractor

1.07 GENERAL REQUIREMENTS

A. Removals - Offer all existing portable and removed equipment to the owner prior to legally disposing of these items. Obtain written permission from the owner for all existing removed items that they do not desire to retain prior to disposal.

B. Provide all equipment outlined and described within this specification and assemble it into a complete, properly functioning system for use by the owner as described within this specification.

C. It is the contractor's responsibility to clarify any misunderstandings or drawing-drawing/drawing-spec discrepancies prior to bid. In cases of a difference between stated quantities in drawings, specs or electrical drawings, the higher quantity will prevail.

D. Check each component before installation as well as each portion of the project during installation to ensure that the intent of this specification is achieved.

E. Painting: The speakers are to be painted to match the ceiling (typically). The contractor will be responsible for obtaining paint from the painting contractor to match the color after the room has been finished. The contractor shall be responsible for all prep work required for painting of the enclosures. The contractor shall warranty the painting of the speakers for 5 years. All mounting hardware shall be painted to match. Verify in writing with the architect color preference for speakers prior to painting.

1.08 BIDDER QUALIFICATIONS – SUBMITTALS:

A. The bidder shall provide references of at least three (3) installations of comparable scope performed by the bidder, including location, system description, and name, address, and telephone number of the architects, consultants, and owners and the names of contract persons for each.

B. The bidder must maintain service facilities and have service available on site within 24 hours. The bidder must be a factory authorized dealer for all products submitted and may be required to submit such proof of factory authorization in writing, or in the form of copies of authorized agreements with the various vendors.

C. The bidder and all persons performing performance sound/AV system related work on this project must be certified (those performing low voltage terminations, system commissioning,

programing, Network addressing and other related areas). This will require the installer to be a factory trained and certified installer (from the equipment supplier) or a crew working under the direct supervision of a certified foreman (of certification described above). This applies to all performance sound/AV equipment installation and any other assemblies indicated as being provided or installed by the contractor. Proof of current certification MUST be provided in the submittals package. Out of date or expired certifications shall not be recognized as meeting the requirements of certification.

1.09 INQUIRIES AND COMMUNICATIONS:

A. All questions shall be generated as called for in the project manual.

B. Direct communications to the consultant via phone are recommended for initial discussion about intent or site issues. (unless prohibited in the project manual). No action may be taken based on verbal communications, they must be followed up in writing as called for in the project manual.

C. Where discrepancies occur and pre bid instructions have not been obtained by written request, the contractor will abide by the owners decision at no additional cost to the owner.

1.10 COORDINATION:

A. Cooperate with other trades to achieve well-coordinated progress at all times. Notify the owner and consultant as often as necessary with regards to job progress or changes in the installation schedule. All conflicts will be reported to the architect, construction manager, owner, and consultant in writing. All reasonable attempts will be made to correct any difficulties.

B. Staff the job site adequately at all times to maintain a progress in keeping with the total project progress.

C. Provide all materials to be installed by others in a timely fashion based upon the related trades' schedules.

D. The job site will be left in a clean safe condition at the end of any workday. All cleanup and debris removal to a site designated by the owner will be the responsibility of the bidder on a daily basis.

E. All storage of tools and materials will be done by the contractor. No on-site storage security will be provided by the owner.

F. The contractor will attend regular meetings with the architect, owner, general contractor, and the consultant when requested by any of the above, in order to achieve project coordination and progress.

G. The contractor shall be required to share all approved audio/AV system shop drawings with all contractors prior to rough-in. He shall work closely with the electrician in determining final device locations, backbox sizes, conduit routings, etc. before the EC has purchased his supplies

and in order to meet the construction schedule. He shall work closely with all contractors prior to any rough-ins in coordinating the stringent requirements and clearances required for the systems equipment.

1.11 DELIVERIES

A. It is each contractor's responsibility to receive all device shipments, equipment, deliveries, etc. for their own equipment on/at the job site personally. Each contractor shall be responsible to arrange for storage of all received materials on site until the appropriate time when they shall either turn them over to installing contractor or install them.

B. If the contractor chooses to allow a third party to receive shipments on his behalf the contractor bears sole responsibility for any missing and/or damaged parts.

C. Any equipment that is furnished by the contractor for installation by others shall be turned over to the installing contractor at a time that fits into their production schedule and the project's overall construction schedule.

1.12 STANDARDS REFERENCES:

A. The contractor is responsible for the provision of material and methods for installation of equipment conforming to the currently applicable standards of:

1. ADA - Americans with Disabilities Act
2. AISC - American Institute of Steel Construction
3. AISI - American Iron and Steel Institute
4. ANSI - American National Standards Institute
5. ASME - American Society of Mechanical Engineers
6. ASTME - American Society for Testing Materials
7. FCC - Federal Communications Commission
8. IEC - International Electronics Commission
9. NEC - The National Electric Code
10. NEMA - National Electrical Manufacturers Association
11. NFPA - National Fire Protection Association
12. OSHA - Occupational Safety and Health Association
13. SAE - Society of Automotive Engineers
14. TIA – Telecommunications Industry Association
15. SMPTE - Society of Motion Picture and Television Engineers
16. UL - Underwriters Laboratories (Electrical components, devices and accessories shall bear a UL label where applicable. UL listed and labeled as defined by NFPA70, article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.)
17. USITT- United States Institute for Theater Technology "Recommended Guidelines for stage rigging and stage machinery-specifications and practices".

B. Provide certification and labels where applicable. Comply with Federal, State, and Local regulations and applicable union regulations where required. All equipment will be furnished with the proper labels for New York State.

C. Provide only equipment that is standard new equipment, the latest model of regular stock product, and is furnished with all parts regularly used with the equipment offered for the purpose intended. The contractor guarantees that no modification of the equipment has been made contrary to the manufacturer's regular practice.

D. Review all materials and equipment prior to installation and notify owner as to any changes or discrepancies between published specifications and the actual material and equipment to be installed.

E. It is understood throughout this document that any referenced standards are intended to refer to the most current version of said standard (even if an older version of the standard is referenced).

1.13 EQUIVALENTS:

A. The successful bidder shall submit any product equivalents prior to award of the contract detailing the kind, type, brand, manufacturer or equipment included in the base bid. Equivalent products must be highlighted on this list. When requested, the successful bidder shall also submit information, describing in specific detail, how the equivalent bid material differs from the appearance, quality and performance required by the base specification. Submittal of the manufacturer's advertising cut sheets alone is not acceptable for proof of equivalency.

B. Proof of equivalency may require the bidder to provide physical samples, a full-sized mockup or specific manufacturer information detailing technical equivalency. Full-sized physical samples/mockups must contain all matching equivalent product equipment (amplifier, processor, stage box, power supply, housing, connectorizations, connection types/locations, etc.). Physical samples/mockups that feature some alternate variant from what is being proposed as an equivalent will not be considered at all. Physical samples/mockups may be required for every different variant of said equipment. Full-sized equivalent physical samples/mockups must be delivered to the owner, architect and consultant (as directed in the submittal review process) for full evaluation and testing and cannot adversely affect the overall construction schedule (products that adversely affect the overall construction schedule shall not be considered at all). Proof of equivalency shall be the burden of the submitting contractor/bidder and not that of the consultant. Proof of equivalency relates to all pertinent functions of the specified equipment, regardless of if that information is reflected on any manufacturer’s issued cut sheets. Final acceptance of equivalent or “or equal” products shall be as indicated below. Along with the above required submissions for equivalent or “or equal” products, the contractor shall submit paperwork detailing the shipment dates/timelines of those products, as this will weigh heavily into the acceptance or rejection of those products as well as their technical aspects.

C. If proposing equivalents that affect the system design as is indicated on the contract drawings, the bidder must submit additional flow charts, detail drawings, manufacturer supporting data and any other drawings necessary to show the differences in the system operation from the primary referenced system.

D. The bidder will pay for any and all changes to related work scope required by the equivalent products.

1. This includes electrical, architectural, structural and other changes that might be needed to implement an equivalent product.
    a. Some products with virtual identical functions have varying power requirements, physical dimensions etc.

E. The risk of whether or not bid equivalents or "or equal" submissions will be accepted is borne solely by the contractor. See section 2.1 "Performance Requirements" and further statements below for more information.

F. No equivalents will be considered after award of the contract unless specifically provided in the Contract Documents.

G. The final judgment as to the equality or equivalency of any product submitted as an "or equal" will be solely that of the consultant, architect, construction manager and owner. The contractor shall abide by these decisions.

H. Equivalents must meet or exceed the specified product's performance characteristics. No product shall be considered equivalent to the specified product if it has lesser performance characteristics in any critical area.

I. All costs for any changes required by other trades to implement the contractor provided "or equal" equivalents will be borne by the contractor.

J. All costs for providing the specified products (or any required rush shipping, etc.) due to the rejection of contractor intended "or equal" products (that have been determined by the consultant, architect, construction manager and owner to not be equivalent) will be borne by the contractor.

1.14 SUBMITTALS:

A. Equipment: The contractor must, after bid award but before ordering any equipment or starting any installation work, submit to the consultant, architect & owner for approval a list of all equipment to be furnished showing types, models, quantities and manufacturer. Attach manufacturer data sheets for all items submitted.

B. The quantity and form (paper and/or electronic copies) of all submittal material required shall be provided by the contractor to the appropriate parties as is indicated in the contract front end documents (in addition to any requirements listed below). If there are no indications in the contract front-end documents, then the contractor shall submit (1) electronic copy of each area, category, etc. of items as listed below. All submissions are understood to be intended for approval by the construction manager, the architect, owner, general contractor and the consultant prior to any fabrication or installation of any devices.

C. Submit a schedule for submission of drawings for fabrication and site work.

D. Submit a complete submission package with all required paperwork.

E. Submit seven (7) copies of material schedules and shop drawings for approval by the architect, consultant and owner prior to any fabrication or installation as follows:

1. Manufacturers cut sheets for all equipment
2. Drawings of proposed mounting methods for all equipment.
3. Samples or cut sheets for proposed marking systems for wire and equipment labeling.
4. Rack layouts, panel layouts and proposed labeling.
5. Schedule for submission of drawings for fabrication and site work.
6. The full set of submitted drawings and data sheets must be presented in a professional manner.
7. All shop drawings for submission must be CADD drawn (created with a computer aided drafting program). Hand drawings are not allowed. Illegible drawings shall not be acceptable.
8. All cut sheets for submission must be clean electronic (pdf) copies of the manufacturer's actual data sheets. Mark up each sheet with highlights or boxes around submitted products, options, etc. No data sheets shall be acceptable that are illegible, poorly photocopied or hand marked up with scribbles, etc.

F. Submit each of the following as each pertains to this project. Provide a copy for each related person performing indicated work who holds these certifications:

1. Current Crestron/Extron certifications
2. Current training certifications.

G. The intent of the submittal package is that it contain one copy of the appropriate cut sheet for each item that the contractor is proposing to use on this project as well as a complete set of shop drawings that shows plan, section and elevation views and details of the entire audio/AV system. Typical drawings to include are as follows:

1. Plan view drawings detailing intended layouts & dimensions, devices shown in scale, wiring & interconnections and all other related device locations.
2. Detail drawings that show all typical attachments, rack elevations, speaker aiming, labeling intents, etc. as well as all custom fabricated devices, suspension intentions, etc.
3. Intended location & dimensions of the projection screen, low voltage control and other related device locations.
4. Submission of this package by the contractor is proof that the contractor has reviewed the entire system design, all site conditions and that he understands the intents of the overall system, installation and related system architecture and that concurs that the designed system will actually function as laid out on the contract documents.

1.15 SYSTEM GENERAL DESCRIPTION

A. Conference Audio & AV System

1. Network Touchpanel Control
2. Video Conferencing Speakers & PTZ Camera
3. Ceiling Mounted Mic Array

4. Flat Panel Display
5. BYOD Connectivity
6. Wiring
7. Tuning, Commissioning training and closeout.

B. Zoom Audio & AV Systems

1. Network Touchpanel Control
2. Integrated video conferencing speaker bar/video camera
3. Flat Panel Display
4. BYOD Connectivity
5. Wiring
6. Tuning, Commissioning training and closeout.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. The requirements of the referenced equipment are not generic in nature. Specific performance, control, and routing capabilities are necessary for any alternate equipment. The details set forth herein and within the functional description of the system are the critical criteria for selection of each piece of equipment.

B. In bidding equipment from manufacturers other than those referenced be aware that all functional information included in this specification as well as the manufacturer's specifications, physical size, serviceability, warranty terms, product availability, and other non technical issues may be determining factors in product equivalency. Final judgment as to equality will be solely that of the owner, architect, and consultant.

C. If the contractor substitutes a piece of equipment that does not meet with all of the critical device functionality of the specified equipment (functionality and feature set as detailed below, inherent in the specified equipment, available as provided option and/or required based upon the intents of the contract documents), then he will have to replace all substandard equipment or substituted equipment that does not meet, match or exceed the specified equipment with either the specified equipment or an alternate piece(s) of equipment that meets/exceeds the specified equipment’s feature set and shall provide all reprogramming, installation, conduit, wire, etc. as is required.

D. Equivalent Criteria:

1. Loudspeakers Equivalents require proof that the substituted product meets all performance requirements including but not limited to:
   a. Frequency Response – On and off axis
   b. Directivity by frequency
   c. Distortion
   d. Phase response
   e. Number of Drivers
   f. Power Handling Capacity and Maximum Output

g. Weight
h. Physical size
i. Rigging options
j. Powering method

2. Digital Signal Processors Equivalents require proof that the substituted product meets all performance requirements including but not limited to:
   a. A/D Converters type and sampling rate
   b. Number of Processors, Mixers, automixer, feedback Suppressors, equalizers, and dynamics devices.
   c. FIR Capability where required by design.
   d. Expandability where applicable
   e. Configuration Capability – Ability to configure as per the specified model.
   f. Interface to other devices digitally where applicable.
   g. Physical Size
   h. Terminals
   i. Input delay
   j. Control software and ability to be controlled via wireless.
3. Microphone Equivalents require proof that the substituted product meets all performance requirements including but not limited to:
   a. Frequency response
   b. Pattern Consistency
   c. Capsule Type
   d. On/Off switch (or the lack of one).
   e. Physical Size.
   f. Color options
   g. Connector size, type and connections
4. LED screen Equivalents require proof that the substituted product meets all performance requirements including but not limited to:
   a. Physical size
   b. Pattern Consistency
   c. Output device type (lamp, laser, etc.)
   d. Acoustic output at nominal and full operating levels.
   e. Color options
   f. Connector size, type and connections
   g. Tensioning system
   h. Available extra drop options.
   i. Auto switching functions.
   j. Available screen types (high gain, front projection, rear projection, etc.)
5. Wire Equivalents require proof that the substituted product meets all performance requirements including but not limited to:
   a. Jacket Type
   b. Number of Conductors
   c. Jacket Shape – i.e., round, twisted etc.
   d. Number of strands and gauge
   e. Flexibility
   f. Capacitance and resistance conductor-to-conductor as well as single conductor.

E. No contractor-manufactured products will be acceptable in place of referenced items except for those items enumerated in this specification as "custom".

F. The current manufacturer's data sheet for each referenced piece of equipment in force at the date of printing of this specification will be the basis for the specifications of the referenced equipment.

G. Specification details are provided only for the features required for current and intended future uses of the products.

2.02 ELECTRONICS:

A. All AC or DC powered hardwired electronic equipment is to meet the following minimum specifications unless otherwise noted:

1. All inputs and outputs will be floating active balanced or transformer balanced. All transformer balancing is to be integral not via outboard transformers. Quasi balanced, ground referenced, or other configurations are not acceptable under this specification.
2. All electronics must carry UL and or CSA approval.
3. All electronics are to employ RFI filtration on inputs and outputs.
4. Input Impedance Range: 10K - 50 K Ohms Balanced
5. Microphone Inputs: ≤150 Ohms Balanced
6. Input Levels: Line inputs +18dB with No Overload
7. Output Levels: Line Outputs + 18dB with No Overload. Output Impedance Range: 50 - 600 Ohms Balanced
8. THD + Noise: < .05 % typical. Hum & Noise > 105dB A
9. EIN: -90 dB (-128 dB Microphone inputs) typical
10. S/N Ratio: 90 dB typical
11. Phantom Power Systems: +48V typical
12. Modular Construction: All equipment is to be provided as serviceable modular style circuitry: i.e., replaceable parts, modules, etc. Devices which utilize a single circuit board for all parts without provision for socketed chips, removable sub-assemblies etc. are not allowable under this specification.
13. Multi-function units may not be substituted for individual equipment types. i.e., a cassette/CD unit may not be substituted for a separate cassette and CD player. Mixer amplifiers may not be substituted for mixers with separate amplifiers. multi-unit (common power supply) wireless systems may not be substituted for single unit wireless systems.

2.03 STEERABLE MICROPHONE ARRAY & DSP

A. STEERABLE MICROPHONE ARRAY: REFERENCED PRODUCT SHURE MXA901

1. The microphone shall be a ceiling array microphone designed for AV conferencing applications.
2. Coverage
   a. The ceiling array microphone shall feature the ability to limit coverage to a specific area while rejecting pickup of sounds in other areas. As shipped, the microphone shall provide Automatic CoverageTM of a single 20 by 20 foot (6 by 6 meter) area.

Within the coverage area, the microphone shall intelligently adapt its audio capture to where talkers are located within the area. The microphone shall be capable of capturing multiple simultaneous talkers in different locations in the coverage area. The microphone shall provide one automix audio output that includes all talkers in the coverage area.

3. DSP
   a. The microphone shall feature onboard IntelliMix® digital signal processing which includes automatic mixing, acoustic echo cancellation, noise reduction, automatic gain control, compression/limiting, delay, and parametric equalization. All DSP blocks shall allow adjustment of selected parameters.
4. Connectivity
   a. The microphone shall provide an RJ-45 connection for audio, control data, and PoE power. Audio shall utilize either Dante or AES67 digital audio networking over a single network cable, and shall be compatible with Dante Domain Manager and Dante Device Lock.
   b. The audio content between the microphone and connected Shure devices (such as the IntelliMix P300 Audio Conferencing Processor or Shure Audio Network Interfaces) shall be encrypted using AES-256 encryption.
   c. The microphone shall be capable of sending and receiving command strings that enable integration with third- party room control systems.
5. Physical Characteristics & Mounting
   a. The microphone shall have a compact 13.5-inch (34 cm) round form factor to complement a variety of ceiling designs.
   b. The microphone shall be available in black, white, or aluminum finishes to match interior designs.
   c. The microphone shall be compatible with in-ceiling, on-ceiling, grid-ceiling, pole, rod, and wire-rope mounting configurations using available accessories.
   d. The microphone shall be IP5X rated.

B. STEERABLE MICROPHONE DSP: REFERENCED PRODUCT SHURE P300-IMX

1. The Digital Signal Processor shall be a Dante-enabled audio interface for installations in meeting rooms. It shall include the Shure IntelliMix® DSP algorithms with 8 channels of microphone processing. The DSP algorithm shall provide acoustic echo cancellation, noise reduction and automatic gain control on all eight channels, in addition to automatic mixing, matrix mixing, delay, compressor and PEQ. Pre-defined templates and presets shall be included to optimise use with Shure Microflex® Advance™ and Microflex® Wireless conferencing microphones.
2. It shall provide connections including Dante (10 inputs, 2 outputs), Analog (2 block in / 2 block out), USB (1 in / out) and Mobile (3.5 mm). A USB 2.0 connection that carries 2 input and 2 output channels (Summed mono) and a 3.5mm Input/Output TRRS connection shall be provided, and both shall be compatible with computers, mobile devices or other all-in-one collaboration devices. The Digital Signal Processor shall be Power-over-Ethernet (PoE+). It shall be of a half rack size with mounting accessories that enable installation under a table or in a cupboard.

2.04 VIDEO CONFERENCING SYSTEM

A. PTZ CAMERA: REFERENCED PRODUCT LOGITECH RALLY CAMERA

1. Zoom: 15x HD zoom (5x optical + 3x digital)
2. Pan: 180° (±90°)
3. Tilt: 140° (+50° / -90°)
4. Field of View
5. Diagonal: 90°
6. Horizontal: 82°
7. Vertical: 52°
8. Total Room Coverage: 262° wide x 192° tall (field of view + pan and tilt)
9. Resolutions @ 30fps: 4K Ultra HD, 1440p, 1080p, 900p, 720p, and SD
10. Resolutions @ 60fps: 1080p, 720p
11. RightLight Technologies: Wide Dynamic Range (WDR), low-light compensation, video noise reduction, low-light saturation optimization
12. Privacy: Lens parks at -90° in sleep mode for assured privacy

B. SPEAKERS: REFERENCED PRODUCT LOGITECH RALLY SPEAKER

1. High-performance 3" (76mm) driver with rare-earth magnet
2. Patent-pending suspension system eliminates vibration-induced camera shake and audio interference
3. Mini XLR cable connects to Rally Display Hub for both signal and power
4. Speaker volume 95dB SPL @1W, 100dB SPL @7.5W, both +/-2dB at ½ meter
5. Sensitivity: 95+/-2 dB SPL at ½ meter
6. Distortion: 200Hz–300Hz <2.5%, 300Hz–10kHz < 1%@7.5W
7. Sampling rate: 48 kHz

C. BYOD INTERFACE: REFERENCED PRODUCT LOGITECH RALLY TABLE HUB

1. Single CAT6A cable connection to Rally Display Hub (16.4 ft / 5m cable included, supports customer-supplied cables up to 164 ft (50 m)
2. Hub 5 m cable included, supports customer-supplied cables up to 50 m
3. Active speaker detection: analyzes audio from up to 7 Mic Pods and 56 beams every 8 ms
4. Connectors
    a. 12 Pin connector for Rally Mic Pod
    b. HDMI Type A passthrough to Display Hub (x2)
    c. USB Type C
    d. USB Type A (reserved for future capability)
    e. USB Type B (connects to meeting room computer)
    f. RJ45 (reserved for future capability)
    g. Power input

D. DISPLAY INTERFACE: REFERENCED PRODUCT LOGITECH RALLY DISPLAY HUB

1. HDMI Type A: (x2) (connects to displays)
2. USB C (connects to Rally Camera)
3. USB Type B (connects to meeting room computer)
4. RJ45: connects to Table Hub
5. Mini XLR: x2
6. Powers one or two Rally Speakers
7. Power input
8. Remote Control

9. RF remote control (line of sight not required)
10. CR2032 batteries (included)

E. ALL-IN-ONE VIDEO BAR: REFERENCED PRODUCT LOGITECH RALLY BAR

1. Sensor
    a. Resolution and Frame Rate
        1) UHD 4K at up to 30 fps
        2) 1440p
        3) 1080p at up to 30 fps
        4) 900p
        5) 720p at up to 30 fps
        6) 480p at up to 30 fps
    b. Image Sensor
        1) Size-Unspecified CMOS
    c. Field of View
        1) Diagonal: 90°
    d. Zoom
        1) 5x (Optical)
        2) 3x (Digital)
2. General
    a. System Connection
        1) USB-A 3.0 / 3.1/3.2 Gen 1
    b. Bluetooth
        1) Yes
    c. Power Source
        1) AC Adapter
    d. Low-Light Correction
        1) No
    e. OS Compatibility
        1) Windows / macOS
    f. OS Compatibility
        1) Windows
        2) macOS
    g. Microphone
        1) 6
    h. Microphone Features
        1) Beam Forming
3. Physical
    a. Privacy Shutter
        1) No
    b. Certifications
        1) TAACompliant
    c. Dimensions (W x H x D)
        1) 35.8 x 6.5 x 5.1" / 910.0 x 164.0 x 130.5 mm
    d. Weight
        1) 249.7 oz / 7080 g

F. TOUCHPANEL CONTROL: REFERENCED PRODUCT LOGITECH TAP IP

1. Display
   a. 10.1" LED Screen with IPS
2. Resolution
   a. 1280 x 800
3. Touch
   a. Capacitive, 10 Points Multi-Touch
4. Brightness
   a. 400 nits
5. Contrast
   a. 1000:1
6. Coating
   a. Anti-Fingerprint Oleophobic Coating
7. Viewing Angle
   a. 85°
8. Angle
   a. Screen Position: 14°
9. VESA Compatibility
   a. 100 x 100 mm VESA FDMI
10. Power
    a. PoE IEEE 802.3af Type 1
11. Wi-Fi Compatibility
    a. 802.11a/b/g/n/ac
12. Bluetooth
    a. 5.0
13. Security
    a. Full Disk Encryption: AES-128
    b. Data Encryption: Symmetric Keys, PKI
    c. Key Protection: Arm TrustZone, RPMP
    d. Device Security: Kensington Lock
14. Operating Temperature
    a. 32 to 104°F / 0 to 40°C
15. Storage Temperature
    a. -40 to 158°F / -40 to 70°C
16. Humidity
    a. 10 to 95%
17. Dimensions
    a. 9.7 x 6.7 x 2.2" / 246.2 x 171.3 x 56.1 mm
18. Weight
    a. 2.2 lbs / 1 kg

2.05 LED DISPLAY SYSTEMS

A. 55” LED DISPLAY: REFERENCED PRODUCT SAMSUNG QB55-C

1. Display

a. Display Size
   1) 55"
b. Aspect Ratio
   1) 16:9
c. Display Orientation
   1) Landscape, Portrait
d. Native Resolution
   1) 3840 x 2160
e. Maximum Brightness
   1) 350 nits / cd/m2
f. HDR Support
   1) Yes, HDR10+/Hybrid Log Gamma
g. Contrast Ratio
   1) 4000:1
h. Response Time
   1) 8 ms
i. Refresh Rate
   1) 60 Hz
j. Color Support
   1) 1.07 Billion Colors (10-Bit)
k. Color Gamut
   1) 72% NTSC
l. Viewing Angle (H x V)
   1) 178 x 178°
m. Horizontal Frequency
   1) 30 to 81 kHz
n. Vertical Frequency
   1) 48 to 75 Hz

2. Surface
   a. Touchscreen
      1) No
   b. Haze Level
      1) 2%
3. Video
   a. TV Tuner
      1) No
4. Connectivity
   a. Inputs
      1) 3x HDMI 2.0
   b. Outputs
      1) 1x 1/8" / 3.5 mm (Analog Audio)
   c. HDCP Support
      1) Yes, Version 2.2
   d. Wireless
      1) Wi-Fi / Bluetooth
   e. USB I/O
      1) 2x USB-A (Unspecified Version) (Photo/Audio/Charging/Video)

f. Ethernet I/O
   1) 1x RJ45 (Unspecified Ethernet)
g. Other I/O
   1) 1x 1/8" / 3.5 mm Serial (RS-232C) Control Input
   2) 1x 1/8" / 3.5 mm Serial (RS-232C) Control Output
   3) 1x 1/8" / 3.5 mm IR Input
h. Multi-Input Support (PIP/PBP)
   1) No

5. Speaker
   a. Built-In Speakers
      1) Yes, 2x 10 W
   b. Speaker Configuration
      1) 2-Channel
6. Hardware
   a. Smart TV
      1) Yes, Tizen
   b. OS Compatibility
      1) Android/iOS
   c. Built-In Mic
      1) No
7. Electrical
   a. Power Consumption
      1) Typical: 154.0 W
      2) Standby: 0.5 W
   b. Input Power
      1) 100 to 240 VAC, 50 / 60 Hz
   c. Power Adapter Type
      1) Internal
8. General
   a. Operating Conditions
      1) 32 to 104°F / 0 to 40°C at 10 to 80% Humidity
   b. Storage Conditions
      1) -4 to 113°F / -20 to 45°C at 5 to 95% Humidity
   c. Certifications
      1) ENERGY STAR, EPEAT
   d. VESA Mounting-Hole Pattern
      1) 200 x 200 mm
   e. Bezel Thickness
      1) 11.5 mm
   f. Duty Cycle
      1) 16 Hours / 7 Days
   g. Dimensions
      1) 48.7 x 27.9 x 1.1" / 1237.9 x 708.8 x 28.5 mm
   h. Weight
      1) 34.6 lb / 15.7 kg

B. 85” LED DISPLAY: REFERENCED PRODUCT SAMSUNG QB85-C

1. Display
    a. Display Size
        1) 85"
    b. Aspect Ratio
        1) 16:9
    c. Display Orientation
        1) Landscape, Portrait
    d. Native Resolution
        1) 3840 x 2160
    e. Maximum Brightness
        1) 350 nits / cd/m2
    f. HDR Support
        1) Yes, HDR10+/Hybrid Log Gamma
    g. Contrast Ratio
        1) 4000:1
    h. Response Time
        1) 10 ms
    i. Refresh Rate
        1) 60 Hz
    j. Color Support
        1) 1.07 Billion Colors (10-Bit)
    k. Color Gamut
        1) 72% NTSC
    l. Viewing Angle (H x V)
        1) 178 x 178°
    m. Horizontal Frequency
        1) 30 to 81 kHz
    n. Vertical Frequency
        1) 48 to 75 Hz
2. Surface
    a. Touchscreen
        1) No
    b. Haze Level
        1) 2%
3. Video
    a. TV Tuner
        1) No
4. Connectivity
    a. Inputs
        1) 3x HDMI 2.0
    b. Outputs
        1) 1x 1/8" / 3.5 mm (Analog Audio)
    c. HDCP Support
        1) Yes, Version 2.2
    d. Wireless
        1) Wi-Fi / Bluetooth
    e. USB I/O

1) 2x USB-A (Unspecified Version) (Photo/Audio/Charging/Video)

f. Ethernet I/O
1) 1x RJ45 (Unspecified Ethernet)

g. Other I/O
1) 1x 1/8" / 3.5 mm Serial (RS-232C) Control Input
2) 1x 1/8" / 3.5 mm Serial (RS-232C) Control Output
3) 1x 1/8" / 3.5 mm IR Input

h. Multi-Input Support (PIP/PBP)
1) No

5. Speaker
a. Built-In Speakers
1) Yes, 2x 10 W
b. Speaker Configuration
1) 2-Channel

6. Hardware
a. Smart TV
1) Yes, Tizen
b. OS Compatibility
1) Android/iOS
c. Built-In Mic
1) No

7. Electrical
a. Power Consumption
1) Typical: 231.0 W
2) Standby: 0.5 W
b. Input Power
1) 100 to 240 VAC, 50 / 60 Hz
c. Power Adapter Type
1) Internal

8. General
a. Operating Conditions
1) 32 to 104°F / 0 to 40°C at 10 to 80% Humidity
b. Storage Conditions
1) -4 to 113°F / -20 to 45°C at 5 to 95% Humidity
c. Certifications
1) ENERGY STAR, EPEAT
d. VESA Mounting-Hole Pattern
1) 600 x 400 mm
e. Bezel Thickness
1) 13.9 mm
f. Duty Cycle
1) 16 Hours / 7 Days
g. Dimensions
1) 75 x 42.7 x 1.1" / 1904.3 x 1085.3 x 28.5 mm
h. Weight
1) 92.4 lb / 41.9 kg

2.06 INSTALLATION WIRE STANDARDS: ALL WIRE IN OR OUT OF CONDUIT WILL BE TYPE CL2-CL3 UNLESS OTHERWISE REQUIRED BY NEC AND JOB SITE CONDITIONS. PORTABLE CABLE EXCLUDED.

A. WIRE – SHIELDED CAT6A NETWORK CABLE: REFERENCED PRODUCT WEST PENN 4346AF

1. Construction:
   a. Conductor Gauge: 24 AWG Solid
   b. Number of Conductors: 8 (4 Pair)
   c. Insulation: Polyolefin
   d. Shield: None
   e. Drain: None
   f. Jacket Material: PVC
   g. Overall Diameter: 0.309” Nom.
2. Electrical:
   a. Temperature Rating: -20° C to +60° C
   b. Operating Voltage: 300V RMS
   c. DC Resistance per Conductor @ 20° C: 9.38 Ω/100 m
   d. Mutual Capacitance: 13 pF/ft Nom
   e. Nominal Impedance: 100Ω +/- 15% (1-1000 Mhz)
   f. Delay Skew: 35 ns/100m MAX
   g. Standards: TIA/EIA568-C.2
3. Mechanical
   a. Minimum Bed Radius: 1.25” min.
   b. Max Pull Tension: 35 lbs.

B. PORTABLE HDMI CABLE: REFERENCED PRODUCT EXTRON HDMI PRO SERIES

1. Performance/electrical
   a. Standards
      1) High speed HDMI® cable
   b. Data rates
      1) 12 feet and shorter Supports 10.2 Gbps
      2) 25 feet and longer Supports 4.95 Gbps
   c. Color depth
      1) 12 feet and shorter Supports 48 bit (16 bits per color)
      2) 25 feet and longer Supports 24 bit (8 bits per color)
   d. Vertical frequency
      1) 12 feet and shorter Supports up to 120 Hz
      2) 25 feet and longer Supports up to 60 Hz
   e. Regulatory compliance
      1) Safety UL CM
   f. Temperature rating
      1) Minimum: -25 °C
      2) Maximum: 75 °C
   g. Voltage
      1) 30 V

h. Pair impedance
   1) 100 ohms ±10 ohms
i. Attenuation
   1) At 0.825 - 2.475 GHz: <21 dB per 12 m
   2) At 2.475 - 4.125 GHz: <30 dB per 12 m
j. Skew
   1) 12 feet and shorter
      a. Intrapair ≤300 ps per 10 m
      b. Interpair ≤2.4 ns per 10 m
   2) 25 feet and longer
      a. Intrapair ≤350 ps per 12 m
      b. Interpair ≤2.42 ns per 12 m

2. General - Physical Characteristics
   a. Connector type 1 male type A HDMI to 1 male type A HDMI
      1) Contacts Gold plated
      2) Material
         a. 12 feet and shorter
         b. Conductors: silver coated, tinned copper
         c. Drain wire: tinned copper
         d. Jacket: PVC
         e. 25 feet and longer Conductors: tinned copper
         f. Drain wire: tinned copper
         g. Jacket: PVC
      3) Conductor guage
         a. 12 feet and shorter Conductors and drain wire: 24 AWG
         b. 25 feet and longer Conductors and drain wire: 22 AWG
      4) Connector dimensions 2.46" L* x 0.80" W x 0.60" thick
      5) 12 feet and shorter
         a. Cable outer diameter 0.41" (10.4 mm)
         b. Bend radius 4.10" (104.1 mm)
      6) 25 feet and longer
         a. Cable outer diameter 0.47" (12.0 mm)
         b. Bend radius 4.50" (114.3 mm)

PART 3 - EXECUTION

3.01 GENERAL:

A. Contractor will adhere to all requirements of the general contract for this project as called for in the project manual.

B. Assess life safety implications of all installation methods and verify there is no compromise of life safety issues. All liability for rigging, fastening, wiring, and other installation methods will be borne by the contractor alone. If the contractor has a reason to believe that safety will be compromised in the installation of any specified equipment in the locations specified they must note this at the time of bid and offer alternatives in writing.

C. Any dangerous work areas marked or roped off in a manner that will inform all persons as to potential danger regardless of sensory handicaps.

D. Maintain M.S.D.S. for all materials used where applicable and submit same if requested upon completion.

E. Maintain integrity of all fire walls and doors during construction and upon completion.

F. Take all precautions necessary to guard against electromagnetic and electrostatic hum, RF noise, supply adequate ventilation, and install all equipment for the maximum safety of the operator.

G. The contractor will verify all on site dimensions prior to ordering or installation of critically dimensioned equipment and wiring. In a case of a discrepancy between these documents and attached drawings, construction documents, and actual on site dimensions the contractor will notify the owner and consultant before making any changes in intended work.

H. Any equipment, hardware, wiring harnesses, or other items not specifically included in this specification but required for the system to function as called for within this specification will be the responsibility of the contractor at no additional cost to the owner.

I. Provide all racks, hardware, wire, conduit, raceways, and all other required parts to provide a complete system to the extent that such items are not provided by others. Provide rack shelves or kits for all equipment to be located in equipment racks that is not inherently rack mountable. Any shelf mounted equipment will be securely attached to the associated shelf.

J. All installation methods must be cosmetically acceptable to the owner. All equipment installed neatly, with respect to level, sight lines, and finish. All wiring must be neatly run and concealed in an orderly fashion and attached to appropriate support structures.

K. Identify any equipment requiring licensing (wireless etc..) and initiate licensing procedures for all such equipment.

L. Coordinate all work with other on site trades in order to achieve a coordinated progress at all times.

3.02 WIRING AND RACKS:

A. CONNECTORS (The priority for use of connectors is as follows):

1. Wherever barrier strips or Phoenix connectors are available to connect equipment these are the preferable means for connection. Barrier connections are to be made utilizing insulated crimp connectors. Phoenix connectors may be utilized without crimp connectors if proper strain relief is provided to avoid fatigue to the connection.
2. Next in order of preference are XLR type connectors. Where no other means is available balanced 1/4" are to be used. Unbalanced 1/4" and RCA are to be use only if no other means of connection is possible. Use right angle jacks where needed for space requirements. Banana jacks are not to be used on amplifier outputs.

3. All wiring (except AC power) entering or leaving the rack will be connected via terminal strips or direct connection to the equipment terminals or connectors. No in line connectors are acceptable. Appropriate connectors and controlled cycle crimping devices will be employed. No wire nuts may be used in any system wiring except AC power.

B. All AR (audio rack) wiring shall be neatly tie wrap bundled (or as indicated otherwise on contract drawings) with wires parallel and perpendicular to rack sides and backs All wiring shall be properly strain relieved as it exits the rear connection points on the related equipment, shall be routed out to lacing bars, shall be routed out along lacing bars to rack side areas and shall be tie wrapped to the lacing bars.

C. All wiring shall be neatly tie wrap bundled (or as indicated otherwise on contract drawings) with wires parallel and perpendicular to rack sides and backs and/or control booth walls or roll top desks (i.e., no random angle wiring). All wiring shall be dressed neatly from devices to input/output plates with excess cable hidden below the countertop and secured as described below.

D. All loose audio, control or power cables & wiring must be dressed neatly with tie wraps & eyes or ring runs & tucked up against underside of control booth countertop. All cabling shall be cut to length.

E. Provide a single 120 V AC 60 LED equivalent light source within each rack, located at the top of the rack as necessary to clear equipment mounted within the rack. Provide rough duty lamps and protective lamp cages for each lamp, as well a switch assembly within each rack.

F. No equipment or terminal strips will be mounted to the sides, doors, top or bottom of the racks. Tie down bars will be provided by the contractor for neat wiring in adherence with industry standard practice.

G. Wiring Standards - Plenum Rated Cable: Unless specifically noted on the drawings, all low voltage wiring is to be CL2/CL3 wiring.

H. No rack rails will be allowed for equipment mounting in the rear of the rack unless otherwise noted in this specification.

I. Separate wiring paths must be maintained within each rack for microphone level, line level, AC, and speaker level signals. No bundling of dissimilar signal types is allowed.

J. No undue stress may be placed on any connection by a lack of support of the wiring within the rack.

K. Any equipment having accessible controls that are not normally used during system operation will have it's controls capped or otherwise locked such that they are not adjustable. If no other means is feasible the use of security covers is mandated. Rack doors are not acceptable as means of tamper resistance for controls.

L. Provide blank and/or vent panels as needed to complete each rack with no unfilled spaces, as per rack elevations or as required by alternates to equipment specified. No racks with unfilled panel spaces shall be allowed.

M. All conduits indicated on the drawings shall terminate directly into racks as shown – top, bottom or at any of the provided knockout locations (unless otherwise and specifically indicated on the drawings as otherwise) and so as not to obstruct access to the racks or adjacent walkways or approaches. Route conduits into racks with as few bends as possible – use sweep elbows where necessary. All wiring shall be protected in conduit until it has reached the internal space of the indicated rack(s).

N. ELECTRICAL & GROUNDING:

1. All equipment to have the availability of chassis ground lifts or to be mounted with ground lift isolation washers.
2. Grounding of shields and chassis shall adhere to industry standard practice, with shields terminated at one end only on signal cables. Terminate the open shield end with plastic tape or shrink on collars.
3. All electronics' ground will be terminated to a single point within the rack. Ground this point as well as the racks to an appropriate main service ground provided by others. No AC line cord safety grounds may be lifted in an attempt to cure hum or noise problems. All such problems will be rectified by accepted industry practice such as the use of transformer isolation, ground lift rack washers, etc...
4. Any AC service shall be installed to standard Edison U-Ground style outlets at the locations noted on the electrical drawings. Where racks are located the service is to be run to the interior of the rack. This service should be capable of powering all system equipment at 100% of rated power. Two U-ground outlets will be available for each 20 amp, single-phase circuit unless otherwise indicated or terminated into MPR style devices.
5. Internal rack AC distribution is the responsibility of the contractor. Acceptable methods: Rack mount power strips, rack mounted power distribution devices, Wiremold style outlet strip.
6. Install all internal AC rack power with all switches and controls carrying hazardous voltage housed in steel enclosures within the rack. Provide positive electrical grounding for all steel enclosures. All AC service will incorporate separate hot, neutral, and ground for each device. All grounds and neutrals will be appropriately bonded and connected to earth as required by codes and industry standard practice.
7. Provide each rack with sufficient AC isolated ground distribution for all equipment with 2 spares per rack.

O. CONDUITS:

1. Use separate conduits for microphone level (below -20dBm), video and line level (up to +30dBm) speaker level (greater than +30 dBm), control circuits and power circuits. No sharing of signal types within conduits is permissible.
2. All conduits shall be concealed unless the owner has been notified in writing and accepts by written approval the location of the exposed conduits.
3. A pull string shall be left in place by the installing contractor after pulling all wiring through each conduit. This pull string shall be tied off at both ends and left for future use.

4. All lines, cabling or wiring in any conduit run must be free from any splices or junction points.
5. All lines, cabling or wiring must be free from damage. Any that exhibits stress, damage, intermittent signal problems, data errors or other anomalies due to excessive pull torque shall be replaced by the installing contractor at no additional cost to the owner.

P. JUNCTION/GANG BOXES

1. Unless otherwise specified all controls, receptacles, user interface stations, plugs and outlets shall be located in an appropriately sized gang box. No multi-gang backboxes with raised, tile ring, extension ring or mud ring style reducers to obtain the specified faceplate gang size shall be acceptable in lieu of the indicated device backbox. Any multi-gang devices with these extension rings used shall be replaced and the specified backbox sizes provided by the EC at no additional cost to the owner.
2. Any junction (i.e., terminal blocks, punch down blocks etc.) shall be housed in metal enclosures with an attached ground. No such connections may be made in ceiling spaces or other areas without the use of a steel enclosure.
3. Any added junction boxes shall be sized and located for ease of troubleshooting access and all connections within shall be connected on terminal strips, which are clearly identified, in a logical, consistent & permanent manner.

3.03 ASSEMBLY & PRE-TEST

A. All equipment shall be turned on and before assembling into racks. No equipment may be delivered to the site without being fully tested off site. The equipment does not need to be under load during this period, although the contractor should shop test each piece of equipment for signal flow integrity.

B. All sub assemblies and individual components (i.e., speakers etc.) shall be fully tested off site before delivery for installation.

3.04 FINISHES & CLEANING:

A. All finishes shall be returned to their original finish and condition after any temporary machining or other work.

B. Cover any walls, furniture, finished floors and carpeted.

C. Cover and protect all equipment left or installed on site during construction.

D. Maintain clean work areas, removing all debris daily.

3.05 LABELING:

A. All switches, cables, wire, controls and outlets will be permanently and logically marked during installation. Permanently mark cables with an identifying label at each end, in a consistent logical manner. Submit to the consultant for approval a listing of intended nomenclature.

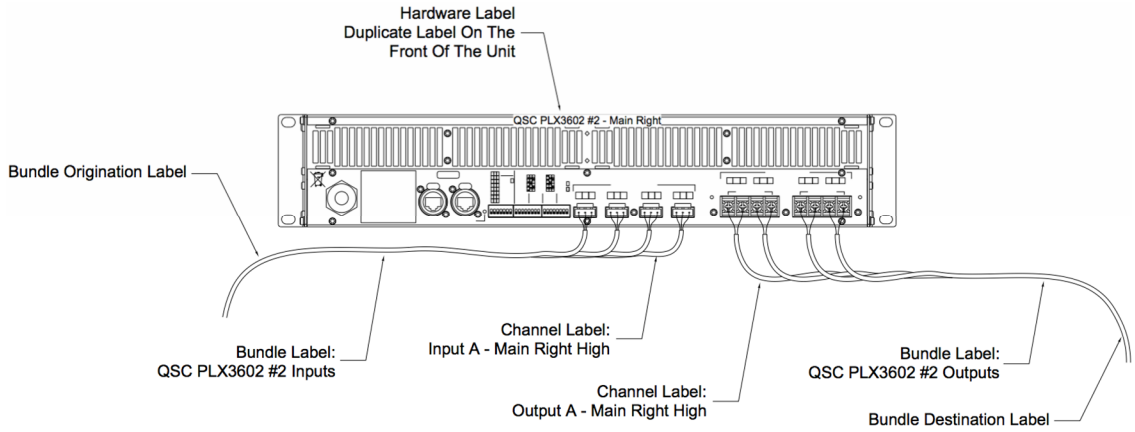
B. On metal panels and plates where possible engrave directly upon the plates and assemblies. Where disassembly of the equipment would be required to achieve engraving the use of adhesive or screw on engraved labels will suffice. Engravings will be paint filled for best contrast with black or white paint.

C. Do not use Dymo style labels or hand lettering. No cables will be labeled with masking tape, Gaffer tape, or other material subject to degradation. Such labeling may be done on a temporary basis during installation so long as all such labels are removed and their adhesive cleaned off when final labeling is applied. Self-laminating labels are preferable such as laser printed labels by Panduit.

D. Color-coding of the entire system will be logical and adhere to accepted industry standards.

E. Labeling must allow the owner and potential novice users to disconnect a piece of equipment or peripheral equipment and reconnect it without the need for drawings or assistance from the installing contractor. Labeling must be done in a manner that precludes errors in connecting. If multiple inputs of the same type (such as XLR, 1/4" etc....) are present in a location the labeling must be detailed.

1. All equipment shall be labeled on the back as to it's function and where multiple units are present the unit number.
2. All input wiring shall be bundled and all output wiring shall be bundled separately with the bundle labeled with the same nomenclature of the hardware. See example below:



3.
4. Examples: Input 1 (XLR) plugged into an XYZ mixer should be labeled "INPUT 1 XYZ Mixer" if this mixer is located in a rack with other XLR input equipment. If this was a front of house mixer with only XLR inputs to the mixer then a snake labeling system of numbers only would be acceptable.
5. At the same mix positions, any 1/4" lines used for processing, sends, etc. would need to be labeled to match the nomenclature on the mixer and the associated line or piece of equipment due to multiple 1/4" jacks being present. A jack plugged into "AUX 1 OUT" should be labeled as such. If the other end plugs into "XYZ REVERB INPUT LEFT", it should be labeled as such.

6. Where network switches are being provided as part of the audio system, the contractor shall label all wiring destinations. Labels should describe network connection locations.
7. All punchdown block wiring shall be labeled on both the input and output. Input wiring shall be labeled with its origination and output wiring shall be labeled with its destination.

F. Labeling is subject to an extended warranty as noted in the "Warranty and Service" section within these specifications.

3.06 RIGGING:

A. The following minimum standards apply in addition to the standards referenced elsewhere in the specification. These guidelines do not negate the standards referenced elsewhere in the specification.

B. All equipment not described as portable in this specification will be rigidly held in place.

C. All equipment will be supported at a minimum of three points plus a backup. Each point must be able to carry the entire rated load with a safety margin of at least ten (10) times the rated load. All methods must incorporate an independent safety backup with a safety margin of at least ten (10) times the rated maximum load as installed in case of failure of any rigging component.

D. Speakers:

1. All speakers that are to be suspended must have factory installed and rated rigging points. No loudspeaker may be modified in any way by the contractor for installation by suspension. Speaker hanging hardware for the speaker must be furnished by the manufacturer or an approved rigging hardware manufacturer.
2. Speakers to be installed on brackets or mounts must utilize factory supplied components. No field fabricated brackets are acceptable unless authorized in writing before installation.
3. Where Omnimount brackets are used for mounting, the contractor should use the manufacture provided mounting points for the approved Omnimount. If a speaker model does not have the points where necessary, the contractor will need to drill the enclosure with the proper hole spacing. The contractor will need to internally span every 2 mounting points with 1/4” angle. No T-nuts will be accepted as mounting points.
4. For speakers utilizing flytrack to obtain the aiming angles, a duplicate set of double-stud fittings in the fly track with wire rope to structural supports is required. Wire rope to be properly dressed and tied off every 12” with nylon zip-ties with all excess cut off. Provide a safety cable from a manufacture provided hang point directly to structural steel.
5. Speakers installed with a Polar Focus Z-Beam or approved equivalent are to incorporate a safety cable from the speaker directly to main steel. All support from the Z-Beam to the speaker will be as indicated on the drawings.
6. Speaker audio cables are to be dressed along the nearest support cable. Audio cables are to have no tension and are not to alter in any way the aiming angle of the speaker. Speaker cables to be properly dressed along support cables.

E. All speakers that are suspended with overhead rigging are to be supported by 3 separate points plus a safety back-up cable. The safety back-up cable must be directly attached to structural steel. The safety cable is to have little or no slack.

F. All hardware used for rigging of speakers or other audio equipment to be installed with a torque wrench set to the manufacture settings.

G. All rigging and related fastening methods must be treated as permanent. All threads must be treated with vibration compounds such as vibratite or loctite as per manufacturer's recommendations.

H. All rigging hardware must be load rated with the load rating or approval stamped on each piece of hardware.

I. No chain of any type will be acceptable for the hanging or backup support of any equipment unless specifically called out on the drawings.

J. No fabric or plastic devices of any type will be considered as acceptable methods of hanging of any equipment.

K. No stainless steel rope may be secured with threaded compression type fittings alone (Crosby Clamps). Compression type closures such as Nicopress must be utilized. All wire rope is to have strain relief thimbles installed. All Nicopress crimps to use copper sleeves.

L. All loose ends of the wire rope will be neatly taped down after Nicopress is installed and crimped. No frayed rope ends will be allowed under this specification.

M. Where shackles are used in the rigging of speakers or other audio equipment, the shackles are to be moused with industry standard mousing wire. Mousing wire to be neatly trimmed.

N. All rigging work is to be done by a rigging contractor unless the sound contractor can supply documentation of their personnel having appropriate training in rigging.

O. All rigging tools such as nicopress crimping tools must have been calibrated within 6 months of the date of installation.

P. Contractor to have a go/no go Nicopress gauge on site for testing of crimps. Every 6th crimp should be tested. If a crimp tests no-go, all crimps between the last passing test and the failure to be tested. Any crimps that fail are to be replaced.

3.07 ROUGH-IN:

A. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, etc. Verify final locations for rough-ins with field measurements and with the equipment being connected. Verify exact location and elevations at work site prior to any rough in work. DO NOT SCALE PLANS. If field conditions, details, changes in equipment or shop drawing information require a significant change to the original documents, contact the owners representative for approval before proceeding.

B. All equipment locations shall be coordinated with other trades to eliminate interference with required clearances for equipment maintenance and inspections.

C. Coordinate work with other trades and determine exact routing of all duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Verify with Owner's Representative exact location and mounting height of all equipment in finished areas, such as thermostats, fixtures, communication and electrical devices, including panels. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for Diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers and other items. Do not rough-in contract work without reflected ceiling location plans.

D. Before roughing for equipment furnished by Owner or in other contracts, obtain from Architect and other Contractors, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment.

E. For equipment and connections provided in this contract, prepare roughing drawings as follows:

1. Existing equipment being relocated: Measure the existing equipment and prepare drawings for installation in new location.
2. New equipment: Obtain equipment roughing drawings and dimensions, then prepare rough-in drawings.

F. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements

G. Provide code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation.

3.08 CUTTING AND PATCHING:

A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction work on the architectural drawings. Refer to "General Conditions of the Contract for Construction" for additional requirements. Patch all cut or abandoned holes left by removals of equipment or devices. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces. Patch openings and damaged areas equal to existing surface finish (i.e., “patch to match existing”). If no instructions exist in the contract documents addressing these issues, then the contractor shall contact the architect and construction manager in writing prior to proceeding with any work in order to obtain written instructions regarding this type of work.

3.09 CONCEALMENT:

A. Conceal all contract work above ceilings and in walls, below slabs and elsewhere throughout building (this does not include control consoles, input stations, user interface devices,

touchscreens, etc.). If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review and written authorization and instructions on how to proceed.

3.10 PERFORMANCE:

A. PROCESSOR SET UP: Unless otherwise instructed within the following is the basic configuration for all processor systems:

1. Speaker Equalization: All speaker specific equalization to accomplish room preference curves, control speaker anomalies, provide high pass, low pass, or bandpass capabilities shall be accomplished on output DSP filter banks. Limiters shall be applied to prevent system overload. Verify required settings with speaker manufacturer data and amplifier voltage gains.
2. Program inputs shall operate with no filters applied unless a preference curve is called for by the owner. All program inputs will include a compressor set to a threshold of 3dB below nominal operating level of the equipment connected. Set controls for soft knee compression, ratio of 6:1, attack time 30 Ms and release of .33 seconds unless conditions require different settings.
3. Program inputs shall incorporate gates set to eliminate background hiss of the equipment when program is not present. Set threshold and characteristics for a gradual fade out when program drops off. Low level program material must not allow gates to activate. Typically -55dB sensitivity.

B. TOUCHPANEL SETUP:

1. The touchpanel shall be set up in accordance with campus standards.

C. TEST EQUIPMENT: (All test equipment will remain the property of the contractor.)

1. Loudspeaker phase checker.
2. Digital Multimeter - May be included with AC voltmeter.
3. SMAART other DUAL FFT Analyzer with calibrated microphones.
4. All cables, adaptors, etc. required for test procedures enumerated.
5. Two walkie-talkies.
6. Laptop PC loaded with all DSP control software loaded. A cable or wireless access point of at least 100' to interface to the DSP's must be onsite during acceptance tests.

3.11 INITIAL POST COMPLETION TESTS & SET UP:

A. Parasitic oscillation and RF pickup: Verify that the system is free from RF pickup and oscillation with no input as well as normal operating levels.

B. Loudspeaker phasing: Check each loudspeaker with a phase measuring device for proper polarity.

C. Proceed to equalize all systems to conform to the specified initial performance criteria.

D. Uniformity: Measure each speaker system on axis within direct field coverage. Equalize to +-3dB 150 Hz – 8000 Hz using impulse sweeps. Where delay or down fill elements are included perform direct field measurements of each area with all systems operating.

E. Distortion, rattles, and buzzes: With high quality digital program material set the equalized systems for average levels of 90 dB check for unusual distortions or rattles. Also apply a constant sine wave sweep from 80 Hz - 8000 Hz at a level providing average levels of 86 dB measured at standing ear height. Walk through all systems and check for unusual distortions or rattles. Correct any problems. If the problem is outside of the system, bring the source to the attention of the owner. (Ceiling tiles, etc.).

F. Gain Control Settings: Adjust controls for optimum signal to noise of all systems relative to the performance requirements of this specification.

G. After initial tests have been made, proceed to equalize the system for feedback control as per normal practice.

H. Verify all systems inputs, outputs, equipment and functions.

I. Console Patching: Verify all stage boxes and other patchable devices are synchronized and patched to access inputs as needed for the system configuration.

3.12 OWNER INSTRUCTION:

A. The contractor shall provide a training program for the owner at the project location and with the project equipment (owner's equipment), consisting of the following hours/periods of instruction specifically and exclusively regarding the audio and AV systems and related equipment. This training time shall not exceed (8) hours. No training block shall be less than four hours in duration. This time is in addition to training times noted below. Final Adjustment visit hours are not included in the training hours, they are additional. See Section 3.23 D.3 below.

B. All owner instruction and programming services shall be provided by the contractor as part of this contract & shall be scheduled and performed within twelve months of the final system turnover date to the owner. Any unused training hours that do not get utilized during that twelve month period shall be considered forfeit.

1. The turnover date is defined as the date of completion of all open punch list items and final acceptance by the owner.
2. Attendees/trainees shall be as designated by the owner and may consist of multiple groups requiring separate training sessions on the same topics (all sessions must fit into the training times as allotted above).

C. All owner instruction training hours are exclusive of travel time. Training time hours will begin to elapse at the prearranged hour agreed upon by both the owner and the contractor.

D. It is understood that, if there are multiple spaces/locations (e.g., high school auditorium, middle school gym, elementary school cafetorium, etc.), the training sessions noted shall be required independently at each facility.

3.13 TRAINING:

A. Training must provide useful information that covers all major topics of how a system would typically be used by an end user/owner. This also applies to documentation and video training.

B. Provide training only at the request of the owner's authorized representative(s). Make clear (in writing) to the owner's authorized representative(s) that any training hours not formally requested, scheduled and performed within twelve months of the final system turnover date to the owner shall be forfeited.

C. Track all training hours in writing and provide copies of attendance sheet sign-offs to the owner of who attended, how long each session lasted and what topics were covered.

D. On a job-by-job basis the training sessions may vary significantly. The training hours allotted may be used by the owner as required for any purpose related to the system and in any number of ways that may not relate directly to the hands-on training. These required hours can be utilized in order for the contractor to perform additional system programming, fixture manipulation, customizing layouts, control screen optimizations/changes or any other related work requested by the owner – up to the "not to exceed" hour totals listed in these specifications.

E. Additional training or programming work beyond that indicated in these specifications or after the initial twelve-month period shall be at additional cost to the owner.

F. Turn over copies of all video recorded training to the owner as described below.

3.14 QUALIFICATIONS OF TRAINERS:

A. All persons performing system training must be experienced operators of the specific equipment they are training others to use. If no one on the contractor's staff has experience on a specific device or piece of equipment, then the contractor must provide qualified third-party personnel in order to perform those training sessions.

3.15 SCHEDULING FOR TRAINING:

A. All training sessions must be scheduled with the owner and by the contractor with at least two weeks advanced notice.

B. If the contractor arrives for a scheduled training session and the owner personnel are not present, then the contractor must notify the owner that a four-hour training segment has been forfeited.

C. If a scheduled session lasts less than four hours, it will still expend four hours of allotted training time due the owner.

D. Training session must be scheduled and performed at a time when the space is available and otherwise unoccupied.

E. Coordinate all training sessions with the owner, all uses of the room, any related contractors, attendees, etc. Training sessions, especially those being videotaped, shall not be allowed while other uses of the room are in session, especially those involving the use of construction equipment, drills, saws, rehearsals, etc.

3.16 SIGNAGE:

A. A sign shall be posted in an accessible location (typically on the rack(s) or in the control booth) providing the name, address and phone number of the primary system contractor, manufacturer and supplier (if not already listed) of the system equipment.

3.17 WARRANTY AND SERVICE:

A. The contractor guarantees all equipment, materials, and workmanship to be free from defects for a period of one year from the date of owner acceptance. This warranty supersedes all manufacturers warranties for the one-year period. Any manufacturer's warranty that exceeds the one year will continue to be applicable. The contractor will replace any defective materials at no charge to owner. Any equipment replaced during the one-year warranty will have a new one-year warranty to the owner.

B. The contractor guarantees all labeling to be free from defects for a period of two years from the date of owner acceptance. In cases where the label's adhesive fails or the label suffers from degradation causing it to become unreadable, the label will be considered defective and will be replaced at no cost to the owner.

C. The contractor will respond by phone to requests for service within 2 business hours and respond with a technician being sent (if needed) within 1 business day.

D. Any equipment that tends to "drift" or whose performance deteriorates during the warranty period will be considered defective, even if such drifting is normal during break in. This equipment will be readjusted at no charge to the owner.

E. Provide all service at the owner’s location regardless of any manufacturer warranty terms regarding carry in service.

F. During the warranty period if any equipment failed will take more than 24 hours to repair, the contractor will make available and interconnect at no cost to the owner suitable temporary equipment to maintain a fully operational system until repairs are complete.

3.18 DEMONSTRATION AND ACCEPTANCE:

A. CONDITIONS FOR SCHEDULING FINAL ACCEPTANCE:

1. The system is required to be complete and fully tested. Any failure that may have occurred between the contractor's final tests and the date of acceptance will be noted and can be corrected after that date. All of the following conditions must be met before scheduling an acceptance test:

B. PROCEDURE FOR SCHEDULING FINAL ACCEPTANCE:

1. The contractor shall notify the owner and consultant of a proposed date and time for the final acceptance tests. The contractor shall include two alternate dates and times. The dates proposed will be a minimum of fourteen (14) calendar days from the date of the proposal.
2. The owner and consultant will respond within two (2) business days as to whether the date and time for final acceptance tests has been approved.
3. If none of the dates and times are acceptable, the owner and/or consultant will submit two alternate dates and/or times to the contractor.
4. If the dates and/or times proposed by the owner and/or consultant are not accepted, the contractor, owner, and/or consultant will continue to alternate per these procedures until an acceptable date and time has been found.

C. DATE OF TESTS:

1. Test equipment as enumerated above must be set up and operational. A technician familiar with the equipment must be on hand.
2. Tools must be on hand to remove connector plates and provide for other possible inspections.
3. All racks must be open and all security covers removed.
4. Documentation for all wiring must be completed in at least a neat draft form and on site. This must include as built nomenclature and wiring schedules.
5. The control software must be programmed, and all equalization completed for the presets and scenarios as indicated.
6. The control laptop computer must be located in the middle of the seating area for the room to be tested. The technician who performed the programming must be on hand for the testing and acceptance.
7. Any time required resolving any of the above conditions will be billed by the consultant at the rate of $100.00 per hour to be deducted from the contractor's remaining balances with the owner. Any time waiting for the contractor to set up test equipment or locate microphones or other required equipment will be billed at the same rate and in the same manner.
8. Changes to the tuning accommodate subjective assessments will be done during acceptance. These adjustments will incur no costs to the contractor.

3.19 CONDITIONS OF ACCEPTANCE:

A. It is understood that the consultant cannot inspect every aspect of the installation. The contractor is responsible for installation quality and methods, fabrication quality and methods, and performance of their work. Acceptance of the project will constitute an acceptance of the following:

B. All specified equipment is installed, and the system is operating in an acceptable manner from a functional standpoint.

C. Upon completion and acceptance of the project the contractor will provide to the owner a letter stating that all of the equipment and installation methods meet or exceed the specification requirements in all respects, and that the system as installed meets all of the applicable standards and codes required under the specification and meets applicable federal, state, and local codes and laws.

D. Final adjustments for the sound system presets will likely need to be changed in the days following completion. This will require the participation of the contractor at several events over as much as forty-five (45) days after system acceptance. These adjustments will be made at no additional charge and upon reasonable notice by the owner. These visits will not exceed a total of (8) eight manhours on site (excluding any travel time).

E. ACCEPTANCE TESTS CHECKLIST:

1. Prior to acceptance testing there are a number of conditions that need to be verified. There are also site conditions required for the consultant to perform tests as indicated. The contractor shall ensure that every item on this checklist has been performed and verified prior to the consultant's acceptance tests can begin. Scheduling of the consultant to perform final acceptance tests must be coordinated with the owner, the project's construction manager (or clerk of the works), the contractor and the consultant (See paragraphs above for detailed requirements).
2. GENERAL:
    a. No other contractors may be working within the rooms to be tested during tests.
    b. No rehearsals or other activities may take place during tests.
    c. The contractor must verify these conditions can be maintained during testing.
3. AUDIO – TYPICALLY TAKES 4-8 HOURS:
    a. Required Attendance – Personnel from the sound contractor equipped with test equipment as required within specifications. All test equipment set up and ready for use.
    b. All room finishes complete. The sound systems may not be tested until carpeting, chairs, acoustical panels, stage curtains, etc. are all installed.
    c. System Status:
        1) All labeling complete
        2) Front of equipment faces
        3) Rear of equipment panels
        4) Cabling & cable dress
        5) Plates installed with all trim rings present
        6) Snakes and output cabling
    d. All security covers removed, but on site ready for reinstallation after tests.
    e. All systems must be fully wired and gain structured – free from buzzes, hum and noise.
    f. The system must be equalized as required within specifications. Additional tuning will be done during acceptance, but primary equalization should be done prior to acceptance.
    g. All microphone inputs and line level outputs tested for continuity and operation.
    h. All intercoms tested on all circuits and able to be verified.
    i. Hearing assistance system tested and ready to be verified.

j. Recording systems set up and calibrated for expected gain.
k. All wireless systems must be coordinated for frequencies with no interference in the locality they are installed. Units should not unsquelch or exhibit any noise issues even if all transmitters are not in use.
l. All wireless must be walk tested for dropouts and set up for drop out free performance and frequency coordinated.
m. Automixer must be set up and operational with appropriate gain structure for each input type. All aux sends routed and gain structured for monitor feeds and ADA.
n. All auxiliary gear and record systems tested.
o. HVAC system operational and able to be controlled if needed.
p. Interface at the booth location to all DSP and digital consoles with software and laptop must be set up and operating. A programmer from the sound contractor must be on site fully versed in all DSP and console operations and programming. Adjusting the system from the rack or backstage is not acceptable. Speakers shall be grouped by function in the processor for ease of changes.
q. Speakers shall all be wired properly, in phase and aimed and steered as per the contract documents.
r. Processors must be programmed with all factory parameters for each loudspeaker type. This includes stage monitors.
s. Each speaker and each section of biamp/triamp speakers needs to be able to be fully controlled during testing, as well as all processor setting. If this requires additional personnel at the amp racks with walkie-talkies or cell phones these persons need to be available.
t. Audio control console must be set up with the proper cards installed and all addressing, programming and patching fully complete.
u. The ADA system must be fully functioning with levels set, source selection and a quality signal present at each receiver and throughout the room.
v. All green room feeds shall be present, tested and without hums, buzzes, ground bars, etc.
w. Verification in the form of signed documents that all portable equipment has been delivered to the owner per specs and drawings. Portable equipment must be available for visual inspection as well.

4. VIDEO & PROJECTION SYSTEMS – TYPICALLY TAKES 1-2 HOURS:
   a. Projectors properly adjusted for contrast, color and resolution input by input.
   b. Control system programmed to allow all operational modes.
   c. Source material set up for viewing:
      1) DVD – HDMI or analog as required by design.
      2) Demo DVD for viewing if system is DVD equipped.
      3) Excel spreadsheet
      4) Test patterns – Grayscale – SMPTE Bars, Luma Ramp.
      5) HDMI test generator if the system is HDMI compatible.
   d. Any other specific software such as Final Cut Pro, etc. must be configured with appropriate surround sound assignments.
5. CONTROL SYSTEMS – TYPICALLY TAKES 1-2 HOURS:
   a. All control system equipment installed and fully functioning.
   b. All control system software programming complete.
   c. All touchscreen controls fully programmed and functional (i.e., all buttons, pages, commands, etc. must work and execute intended tasks).

d. All touchscreens must mirror each other and all pages update to both screens as to current selection status, etc.

3.20 CLOSEOUT DOCUMENTATION

A. All closeout documentation including training videos must provide the owner with usable training. The determination of acceptability will be determined by the Consultant. Poor quality training videos and documents will be rejected.

B. Closeout Documentation is to be submitted within two weeks of system completion.

A. Contractor must submit the following items. All items should be part of the O&M Manual. Provide the quantity and form (paper and/or electronic) of these closeout documents as is indicated in the contract front-end documentation. Physical copies shall only be required if front-end documentation requires them.

B. System testing documentation as required by final testing and acceptance procedures outlined in this document.

1. ALL paper copy O&M Manual submissions shall be in heavy-duty, D-Ring style, 3-Ring binders All electronic copies shall be "bound" in an Adobe Acrobat style portfolio (see below for more complete information).
2. Complete technical manuals for all equipment installed.
3. List of serial numbers and MAC addresses of all equipment as applicable.
4. Warranty cards for all equipment.
5. Manufacturer MSDS sheets for all applicable equipment.
6. Operations & Maintenance Manuals shall include English and Spanish only.
7. Operations & Maintenance Manual: An operations and maintenance manual (or "Systems Manual") written in English on the safe use of a that particular sites audio and AV system shall be provided by the contractor to the owner. (provide separate manual sections for different spaces included in this project – each to be a separate, complete and distinct section in the manual for each differing or multiple system and location). This manual should include the following:
   a. Table of contents.
   b. A contractor written simplified guide to operating the system Include at minimum:
      1) A contractor written simplified troubleshooting guide or what to check and where to check if there is no sound or video.
      2) Power up power down of console
      3) Changing between auto and manual modes
      4) A key stroke guide on how to get to menus to check routing, access effects etc..
      5) Constructing and editing scenes
      6) file saves, file loads.
      7) A short list of the required software reset procedures for all audio system related subsystems.
   c. Emergency contact number(s) and procedures to follow in the event of a catastrophic system failure.

d. Maintenance procedures and recommended schedules required for equipment installed that requires regular scheduled maintenance.
e. A DVD (or set of DVD's, depending on requirements listed Under Training Sections above). Thumb drives with sequentially names files is also acceptable.

C. As-Built Drawing Set requirements (required of all prime and sub-contractors):

1. As-Built Drawings (AKA as fitted or as installed): This drawing package is a revised set of "red-lined" construction drawings submitted by each installing contractor upon completion of the project. These drawings must accurately record and reflect the equipment installed, all changes made during the construction process and must also show the exact dimensions, geometry and location of all elements of the work completed under the contract. As built drawings should be added to throughout the construction process as the project gets built.
2. The as-built drawing package must include the following:
   a. Clean, consistent look, layout and markup methodology across entire set
   b. Conduit sizes
   c. Wire types pulled (manufacturer, model, AWG, etc.)
   d. All junction box locations, names, internal components, etc.
   e. Conduit routing (actual installation paths with notes as to elevation, access, etc.)
   f. Panel and circuit numbers for all power related devices
   g. Shop drawing changes
   h. Extra work not originally included in the contract
   i. Field changes
   j. Design changes
   k. Modifications
   l. Labels and dates (attesting to when changes were made and why)
   m. Locations and dimensions (if as designed, state such; if not, indicated all deviations). This should include heights AFF, etc.
   n. Legend or Key explaining all markups, color codes, numbering sequences, etc.
   o. Port assignments and related nomenclature (for all DMX, Data, 0-10V, IP, switches, etc.)
   p. Embedment depth, type & size for rigging related anchors
   q. Accurate details for all installed devices
   r. Equipment relocations (due to required or requested field directives, owner requests, obstructions, etc.)
3. As built drawings must be written in legible, plain English without the use of shorthand, abbreviations, codes, etc. Descriptions shall be clear and concise.
4. As built drawings can also be provided with electronic and technology driven interactions such as embedded photos, GPS data and active links to relevant material.
5. Typical markups that would be expected in all as-built drawing sets:
   a. RED markups indicate where something has been REMOVED, RELOCATED or CHANGED from the original design.
   b. GREEN markups indicate where something has been ADDED to the original design.
   c. YELLOW markups indicate actual routings, locations, etc.
   d. BLUE markups indicate special information that has been included regarding the installation of equipment, conduit & wiring.

6. An accurate and useful set of As-Built drawings includes preparation before the commencement of the project, during the installation process by all involved parties and after the final punch list items have been addressed and corrected.
7. Only include drawings in the as-built set that are relevant to the installed systems. For example, the EC would not include detail drawing as-builts for systems or equipment that he had nothing to do with providing and/or installing (such as Brickhouse arbors or AV system touchscreen layouts).
8. Do not include duplicate pages or pages without any markups. Every sheet included in the as-built set must include all relevant markups as listed above.

D. O&M Manual pdf requirements: The contractor shall provide a pdf copy (with appropriate titles) for each piece of documentation listed above and bound together in a pdf portfolio/binder, labeled with the owner's name and with the submitting contractor's information. All electronic manuals shall contain only equipment and information that pertains to the project. Where factory manuals are available the contractor shall provide these. Where factory manuals are not available, the contractor shall provide high resolution (150 dpi minimum and fully optimized in Acrobat or equal), full page, properly and consistently oriented pages in a consecutive ascending order. All pdf portfolio and binders produced and submitted shall be professionally put together and presented well. All manuals shall be saved as standard Adobe Portable Document Format (PDF).

END OF SECTION

SECTION 281300 - SECURITY AND ACCESS CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Card Access Systems

1. Wired: Card Access Systems (CAS), at the User End, are comprised of card reader, door contacts, electric hinge or power transfer (wired systems), door strike, latch, reader interface module, interconnecting power and communication wiring, head-end intelligent system controller. All systems, unless exempted from University policy, are centrally monitored transmitting data to and received by CUPD Access Control Services.

2. Wireless: Schlage AD400 – is comprised of an AD400 lockset, PIM400-1501 RSI wireless access point, LP-1501, communication wiring with power over Ethernet, and must be installed with an eight-cell battery pack. Every PIM must be installed with an external antenna. The series of AD400 installed must support a secure credential. Cornell IT policies must be adhered to when attaching devices to the University network.

1.2 SYSTEM OPERATION AND PERFORMANCE

A. System operation and performance shall include, but not be limited to, the following features:

1. Proper activation of door hardware when a valid credential is presented.

2. Appropriate shunting of the alarm upon exit from secured space.

3. Video signal being transmitted over IP.

4. Alarm initiation.

5. Trouble initiation.

6. Activation of alarm notification.

7. Activation of trouble notification.

8. Activation of fire safety functions.

9. Total supervision, monitoring of abnormal conditions in the system. 1

10. Activation of off-premise signals that are sent to the HDS via the Bosch Central Station (existing non-Access It! supported systems) or Ethernet (Access It! supported systems).

B. Activation of the fire alarm system shall cause the following:

1. Electric door hardware located on egress doors to lose power and allow egress/ingress where required by fire code.

2. Electrical door hardware mounted to a fire door must close and latch upon activation of the fire alarm system.

3. Delayed egress device must deactivate.

C. Activation of any security device producing an alarm or trouble shall cause, but not be limited to:

1. Transmission of the alarm or trouble signal to the Building ISC(s).

2. Transmission of the selected alarm or trouble signal to the Head-End Database Server (HDS).

3. Indication of the alarm or trouble condition at the computer monitor display at the CW, CPW, and HDS shall include the alarm or trouble description, time/date, building controller, device, input/output, priority code.

D. Activation of any card access device shall cause, but not be limited to:

1. Transmission of the data signal to the Building ISC(s) and HDS.

2. Indication of the data signal including the alarm or trouble description, time/date, building controller, device, input/output, card, and priority code by the computer monitor display at the CW and HDS.

E. Items C and D above define normal operations. In the event of a communication failure between an ISC and the HDS, these signals will be stored and forwarded to the HDS when the communication is restored.

1.3 CONTRACTOR REQUIREMENTS

A. The Contractor providing the security and access system shall be certified NICET Level II, and per Article 6d of the New York State General Business Law.

1.4 IDENTIFICATION

A. Provide lettered identification plates on the following equipment, components, and accessories (Note: Lettered identification plates shall be approved by Cornell University’s Planning, Design and Construction Department prior to installation):

1. Building Intelligent System Controllers (ISCs);

2. Control Modules;

3. Interface Modules;

4. Remote Power Supplies.

B. Provide Lettered “Dyno 100” labels on system devices.

1. The label shall indicate the address and must be located on the device or adjacent to the device if this is not practical.

2. Cabling and devices terminating at the control equipment shall be appropriately labeled with the proper device number or device description. Terminal blocks that are active shall be labeled with their appropriate landing site on the terminal board.

C. Identification Plates and Labels shall be as follows:

1. DRIs shall be labeled DRI–UVWX, where U indicates its respective ISC numeral; and V is the ISC’s respective buss, a value from 1 to 4; where WX are values from 01 to 32.

2. Devices shall be labeled UVWXYZ, where U indicates its respective ISC numeral; and V is the ISC’s respective buss, a value from 1 to 4; WX indicates its respective panel, values from 01 to 32; Y indicates the input or output terminals, a value of 1 for input and 0 for output; and Z indicates its respective input or output terminal, a value from 1 to 4.

3. Examples:

a. DRI-2305 is the fifth Dual Reader Interface served from the third buss of the second Intelligent System Controller in the building.

b. Device #230503 is the device on the third output of the fifth panel served from the third buss of the second Intelligent System Controller in the building.

1.5 MISCELLANEOUS REQUIREMENTS

A. Equipment shall be mounted in a manner consistent with the ability to work around such equipment, and to perform the normal duties required in that area without coming into contact with the control equipment. Control equipment shall be mounted at a convenient height for future servicing.

B. Power transformers shall be mounted in such a way that shall prevent their disengaging, either by vibration, gravity, or an individual unplugging them.

C. Equipment enclosures shall have locking mechanisms that are left locked. Two keys shall be provided. One key shall be supplied to the Building’s Coordinator, and the other key must be supplied to Cornell Campus Police.

1.6 WARRANTY

A. Cornell University Department of Planning, Design and Construction's (PDC) Sr. Electrical Engineer, and the Cornell Police shall approve security systems designs. Coordinate the approval process with the Department of Planning, Design and Construction's Project Manager on capital projects and the Sr. Electrical Engineer on non-capital projects.

B. A final test of the respective security and card access equipment and hardware shall be performed prior to considering the installation to be "complete." Cornell's Sr. Electrical Engineer and Campus Police shall be notified two weeks prior to the completion of the installation of a tentative testing date. On that date, a full system test will be performed according to these guidelines.

C. The Campus Police will give a pass or fail to the system after the test has been completed. When a portion of the system fails during the test, that portion, or the entire test will be tested again. The extent of the retest shall be up to the discretion of Cornell's Sr. Electrical Engineer and Campus Police.

D. Cornell's Planning, Design and Construction Department shall accomplish the initial setup programming prior to the installation. A completed "Installation Checklist" for the facility shall be delivered and accepted by Cornell University's Sr. Electrical Engineer prior to the installation of the system and the actual system programming.

E. Cornell University's building coordinator, for the building implementing the security and access measures, shall supply Cornell University's Sr. Electrical Engineer with the information pertaining to the population residing within, and the traffic patterns and times of operation therein.

F. A warranty shall be provided for labor/workmanship and on hardware included in the installation, for a period of one (1) full year from the date of completion.

PART 2 - PRODUCTS

2.1 CONDUIT, WIRE AND BOXES

A. Communication conductors shall be shielded twisted pairs; #22 AWG (minimum) stranded copper between the ISC and each downstream device. Manufactured by Belden, model #6541FE or equivalent.

B. Low-voltage power conductors shall be unshielded twisted pairs; #18 AWG (minimum) stranded copper between the power supplies and each downstream device. Manufactured by Belden, model #6342FE, or equivalent.

C. Card reader conductors shall be a minimum of 22 AWG./8-conductor, shielded, between card reader and reader interface. Belden model #6563FE or equivalent.

D. Door position switch conductors shall be a minimum of 22 AWG./4-conductor between egress device and reader interface module. Belden model #6541FE or equivalent.

E. Electric locking hardware conductors shall be a minimum of 18 AWG./2-pair, twisted, shielded between head-end power supplies and each downstream device. Belden model #6342FE or equivalent.

F. Security and Card Access circuits and wiring shall be installed in a separate and independent conduit system from other system circuits.

G. System wiring, circuits, and conductors shall be color coded and identified by number at termination points (i.e., control panels, remote annunciators, etc.) and splice points (i.e., junction boxes, splice boxes, etc.).

H. Junction and splice boxes containing card access system wiring, circuits, and conductors shall have black covers and marked “SECURITY” in ¾" (three-quarter inch) white letters.

I. End-of-line resistors in shall be installed at the location of the door contact or other sensor, not at the ISC.

2.2 POWER REQUIREMENTS

A. Provide 120VAC power to the system power supply locations. Where available, provide a dedicated emergency power circuit. This power supply shall be permanently labelled at all equipment it feeds.

B. Provide 12VDC power supply for card access boards, and 24VDC power for other devices (crash bar, door hardware). Negative Reference of these power supplies shall not be used as an earth ground

C. Power supplies for door hardware shall be located in the same enclosure as the RIM serving that door or in adjacent enclosures at the same secure location previously approved by ACP and FMOPS alarm techs.

D. Power supply characteristics must be per hardware manufacturer’s specification.

E. Varying voltage supplies should be kept separate from each other.

F. Panel power supplies must be kept independent of all other components and should be connected to the power supply monitor on the panel where available.

G. Locking hardware should be directly wired to a distribution board; never a series.

H. Battery backup is required for all intrusion, video surveillance and card access systems must be replaced a minimum of every 3 years.

I. The Contractor shall provide power calculations, including load capability and maximum load per power supply, to Cornell Facilities Engineering during the submittal process and at the completion of the project.

J. Basis of Design:

1. LNL-OLSACTXP2

2.3 DOOR HARDWARE

A. Refer to Division 8 for responsibilities.

B. New door installations, opening hardware must conform to the current Americans with Disabilities Act guidelines; either lever set, flip paddle, panic paddle or crash bar hardware is acceptable.

C. Hinges on reverse beveled doors shall be non-removable pins (NRP).

2.4 ELECTRONIC LOCKING HARDWARE

A. Refer to Division 8 for responsibilities. Division 26 shall coordinate electrical requirements with Division 8 specifications and plans.

B. Use of magnetic locking hardware, electric strikes and standalone keypad locks is not permitted without obtaining an exemption from FM Operations Lock Shop Technician, CUPD Access Control and the Director of Risk Management.

C. Electronic hardware in the building shall use one standard voltage. Applications shall operate on 24VDC voltage. Deviations from this voltage are unacceptable without prior written consent by the University's FM Operations Fire/Alarms & Security Technician and FM Operations Lock Shop Technician. Existing electronic hardware that is not feasible to replace is an acceptable reason to deviate from this voltage. In applications where the latch bolt of the locking mechanism can be accessed from the outside of the door, a latch guard, or astragal, must be installed over the locking mechanism to prevent retraction of the latch bolt, allowing release of the door to an open condition.

D. Electronic locking hardware must be installed in a fail-secure configuration.

E. Delayed egress devices must release to an unlocked position on any fire alarm activation where required by local fire or building codes.

F. Fail-Safe operation will be permitted only in instances where dictated by local fire or building codes.

G. On fire rated doors, latch retraction mechanisms must release to latched position and magnetic door hold open devices must release upon receipt of a signal from the building fire alarm system.

H. For electric strike configurations, the strike must be installed in a flush-mounted configuration, properly adjusted to allow the anti-tamper mechanism on the lever set to be engaged. Surface-mount configuration will be allowed where warranted by the door configuration (i.e. concrete filled jamb) or by the hardware configuration (i.e. mechanical crash-bar).

2.5 INTELLIGENT SYSTEM CONTROLLERS (ISCs)

A. General

1. The project is responsible to pay the costs associated with providing the dedicated TCP/IP network connection to each ISC location. Request for data must be submitted by the end user or Project Manager at a minimum of two weeks prior to installation. Request should include project account number and monthly billing number. Access Control Program to provide VLAN information.

2. Use of existing or single Intelligent System Controller (ISC) is preferred. Multiple ISCs are acceptable when specifically requested by the customer or approved in design by the CUPD Access Control Project Management team.

3. The integrated system including equipment, components, and accessories shall be UL listed for the purpose for which the equipment, components, and accessories are used.

B. Enclosures

1. Enclosures shall be of the 22 ga. heavy-gauge, galvanized steel, dead-front construction with keyed, lockable panel cover type.

2. FM Operations Fire/Alarms & Security Group must approve panel locations. High Security installations shall have ISC’s installed inside the high security space or be located in another secured location and have unique cabinet locks where the ACC is in possession of the keys.

3. All panels must have tamper switches on the enclosure wired to the cabinet tamper inputs on the controller board.

C. Intelligent System Controller Modules:

1. Host communications shall be direct wire TCP/IP, flash memory for real-time updates, with a minimum of 16MB onboard memory expandable to 64MB. The TCP/IP is over Ethernet at a minimum of 100mbps.

2. Supports up to eight different card formats, with issue code support for both Wiegand and magnetic formats.

3. Will support at least 64 readers or 32 downstream devices, and minimum 100,000 cardholders, 255 access levels, 255 Holidays with grouping, 255 time zones, each with 6 time intervals.

4. Alarm Masking, Individual shunt times, available 6-digit pin code.

5. Two dedicated inputs for tamper and power failure status.

6. Manufacturer: Access It! LP-2500, Access It! LP-1502 or Access It! LP-1501. (Use the Access It! LP-1501 only for Schlage AD400).

2.6 INPUT CONTROL MODULES

A. General

1. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

2. Two inputs are available for cabinet tamper and power fault monitoring. Normally, the contacts are closed. Power fault monitoring should always be in place. The cabinet tamper may be shorted if not necessary.

3. Alarm inputs shall be supervised with end-of-line resistors that are 1000 ohm, 1% tolerance.

4. The Input Control Modules are intended for low voltage, class 2 circuits only.

B. Cabinet: Refer to ISC requirements for Input Control Module cabinet requirements.

C. Input Control Module:

1. Line supervision, with 12VDC power supply.

2. RS-485, 4-wire communications.

3. Sixteen programmable supervised input contacts (use end-of-line resistors).

4. Two form-C 5A, 30VDC contacts for load switching with contact protection.

5. Two dedicated inputs for tamper and power failure status.

6. Manufacturer: Access It! MR-16IN or Access It! MR-16OUT.

2.7 OUTPUT CONTROL MODULES

A. General

1. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

2. Two inputs are for cabinet tamper and power fault monitoring.

3. Contact protection shall be used to minimize premature failure of the contacts and to increase system reliability.

4. The Output Control Modules are intended for low voltage, class two circuits only.

B. Cabinet: Refer to ISC requirements for Input Control Module cabinet requirements.

C. Output Control Module

1. Line supervision with 12VDC power supply.

2. RS-485, 4-wire communications.

3. Sixteen form-C 5A, 30VDC contacts for load switching that support “on”, “off”, and “pulse” control.

4. Two dedicated inputs for tamper and power failure status.

5. Manufacturer: Access It! MR-16OUT.

2.8 SINGLE READER INTERFACES (SRIs)

A. General

1. Dual Reader Interfaces (DRI) are preferred whenever possible due to greater functionality and expansion potential. See section 2.13 below.

2. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

3. Two supervised inputs are for exit request (normally open) and door contact (normally closed) monitoring.

4. Alarm inputs shall be supervised with end-of-line resistors that are 1000 ohm, 1% tolerance.

5. Two output relays support fail-safe and fail-secure operation. One relay shall be used for the strike (locking device) and is capable of 5A; the other relay may be used for auxiliary functions and is capable of 1A.

6. Provide end-of-line termination at the end of the communications line. If the Single Reader Interface is at the end of the RS-485 line, the J4 termination jumper must be set.

B. Power

1. Provide a 12VDC, 125mA power input.

2. 80mA is available from Single Interface Reader for reader TTL power.

3. Circuit with 18AWG (minimum) twisted pair cable.

C. Upstream Communication

1. Port 1, using 2-wire RS-485 interface, is used to communicate with the Intelligent System Controller.

2. RS-485 interface cable shall be a minimum 24 AWG twisted shielded pair.

3. Cable drops to devices from the Single Interface Reader should be kept to a minimum. Drops should not exceed 10 feet.

D. Manufacturer: Access It! MR-50

2.9 DUAL READER INTERFACE MODULES (DRIs)

A. General

1. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

2. Eight supervised inputs, four per door. Inputs per door are for exit request (normally open), door contact (normally closed), and two auxiliary monitoring points (selectable through the software).

3. Alarm inputs shall be each supervised with two end-of-line resistors that are 1000 ohm, 1% tolerance for a total of 2000 ohms.

4. Six output relays support fail-safe and fail-secure operation. All six relays are capable of 5A apiece. Relays per door are for the strike and two auxiliary relays.

5. Provide end-of-line termination at the end of the communications line. If the Dual Reader Interface is at the end of the RS-485 line, the J5 and J6 termination jumpers must be set.

B. Power

1. Provide a 12VDC, 450mA power input.

2. 80mA is available from Dual Interface Reader for reader TTL power.

3. Circuit with 18AWG (minimum) twisted pair cable.

C. Upstream Communication

1. Port 1, use 2-wire RS-485 interface, used to communicate with the Intelligent System Controller.

2. RS-485 interface cable shall be a minimum 24 AWG (minimum) twisted shielded pair.

3. Cable drops to devices from the Dual-Interface Reader should be kept to a minimum. Drops should not exceed 10 feet.

D. Manufacturer: Access It! MR-52.

2.10 IDENTIFICATION

A. Provide lettered phenolic identification plates on the following equipment, components, and accessories as noted below:

1. Building Intelligent System Controllers (ISCs)

2. Control Modules

3. Interface Modules

4. Remote Power Supplies

5. Provide computer-generated adhesive labels on system devices (Brady, Dymo, P-Touch). The label shall indicate the address and must be located on the device or adjacent to the device if this is not practical.

B. Cabling and devices terminating at the control equipment shall be appropriately labeled with the proper device number or device description. Terminal blocks that are active shall be labeled with their appropriate landing site on the terminal board.

C. System Labeling and Identification

1. The description in the notes field of the Access It! access control system shall indicate the location of the ISC's, DRI's, power supplies, PIM's, SRI's, and Video devices and include the date of installation.

2. The location shall include the room number and geographic location in the room itself.

D. Identification Plates and Labels shall be as follows:

1. ISCs shall be labeled ISC–U, where U is a value from 1-9.

2. DRIs shall be labeled DRI–UVWX, where U indicates its respective ISC numeral; and V is the ISC's respective buss, a value from 1 to 4; where WX are values from 01 to 32.

3. Devices shall be labeled UVWXYZ, where U indicates its respective ISC numeral; and V is the ISC's respective buss, a value from 1 to 4; WX indicates its respective panel, values from 01 to 32; Y indicates the input or output terminals, a value of 1 for input and 0 for output; and Z indicates its respective input or output terminal, a value from 1 to 4.

4. Examples

a. ISC-2 is the second Intelligent System Controller in the building.

b. RIM-2305 is the fifth Dual Reader Interface served from the third buss of the second Intelligent System Controller in the building.

c. Device #230503 is the device on the third output of the fifth panel served from the third buss of the second Intelligent System Controller in the building.

PART 3 - INSTALLATION

3.1 CABLE AND RACEWAY SYSTEMS

A. Provide communication system requirements for a fully operational card access system.

B. Installations shall be performed to the current code requirements.

C. Cables shall be routed in raceway systems. Free air, plenum rated cable is not acceptable.

D. Raceway systems shall be installed in a concealed manner; they shall be brought in above an accessible ceiling and fished inside the walls. Surface raceway systems are permitted where ceilings are inaccessible and walls cannot be fished.

E. Cabling shall be run in such a fashion so as to be kept at least 18" away from electric or data lines. In the event that a cable must cross over the path of an AC line, the cable must cross the path at a 90-degree angle to the AC line, thus keeping EMF interference to a minimum. Cabling must be kept at least 18" away from fluorescent lighting ballasts. Wiring installed in door frame components shall be installed to protect from damage and allow for future repairs or upgrades.

F. Cornell University Facilities Engineering (FE) must approve any deviations in wire, raceway systems, or raceway hardware.

G. Raceways shall be run from the field device to the head-end termination point in a professional manner, utilizing conduit, beam clamps, wire ties or other devices where necessary. In areas where the raceways are to be run above the drop ceiling, conduits shall be routed together where possible. Routing shall be in a workmanlike manner, with raceways mounted so as not to interfere with the servicing of other building infrastructure systems in the future. Electrical work shall conform to the latest local codes and the National Electric Code (NEC).

H. Specifications for Ethernet cabling: 1

1. All cable should comply with CIT cabling standards, be full copper and a minimum rating of CAT6. CCA (Copper Clad Aluminum) cabling shall not be used.

2. All cabling should adhere to current NFPA and NEC requirements for power over Ethernet.

I. Communication conductors shall be shielded twisted pairs; a minimum 24 AWG./2- pair stranded copper between the ISC and each downstream device. Manufactured by Belden, model #9842 or equivalent.

J. Adequate conductors shall be provided to allow for all functions the equipment is capable of providing regardless of use at the time of installation.

K. Low-voltage power conductors shall be unshielded twisted pairs; a minimum 18 AWG./4-conductor stranded copper between the power supplies and each downstream device. Manufactured by Belden, model #9157, or equivalent.

L. Card reader conductors shall be a minimum of 22 AWG./6-conductor, shielded, between card reader and reader interface. Belden model #9942 or equivalent.

M. Door position switch conductors shall be a minimum of 22 AWG./2-conductor between egress device and reader interface module. Belden model #8442 or equivalent.

N. Electric locking hardware conductors shall be a minimum of 18 AWG./2-conductor, between head-end power supplies and each downstream device. Belden model #8461 or equivalent.

O. System wiring, circuits, and conductors shall be identified by number at termination points (i.e., control panels, remote annunciators, etc.) and splice points (i.e., junction boxes, splice boxes, etc.).

P. Junction and splice boxes containing card access system wiring, circuits, and conductors shall have blue covers.

Q. End-of-line resistors shall be installed at the location of the door contact or other sensor, not at the ISC.

3.2 MOUNTING REQUIREMENTS

A. Equipment shall be mounted per manufacturer installation instructions and in a manner consistent with the ability to work around such equipment, and to perform the normal duties required in that area without coming into contact with the control equipment.

B. Control equipment shall be mounted at a convenient height for future servicing. Control equipment shall be mounted in such a way that shall prevent their disengaging, by either vibration, gravity, or an individual unplugging them.

C. Control equipment shall have at least 4 inches of clearance from any non-system component or structure, unless mounted adjacent to another access control panel.

D. Power transformers shall be mounted in such a way that shall prevent their disengaging, by either vibration, gravity, or an individual unplugging them.

E. Existing Equipment shall not be connected to, modified, or otherwise tied into without approval from FMOPS Alarm Techs prior to installation start.

3.3 SYSTEM PROGRAMMING – CARD ACCESS

A. Cornell's Access Control Program (ACP) will perform the initial setup programming prior to the installation.

1. Facilities Fire Alarms & Security Technician or a Access It!-certified installer will perform all required wiring and terminations on the board prior to ACP configuration.

2. ACP will perform initial setup programming to include:

a. ISC configuration and labeling.

b. Device hardening.

c. User/Password configuration

d. Creation of the device instance in the access control software.

e. Creation or modification of the Emergency Response access level using the following naming convention (EMERGENCY RESPONSE – Segment Name).

3. Facilities Fire Alarms & Security Technician or a Access It!-certified installer will:

a. RIM (reader interface module) configuration and labeling.

b. Initial test Time Zones and Access Levels.

c. Initially name devices: Facility Name, Room number, Room purpose, compass direction of installation, Interior or Exterior

B. The building/unit access control coordinator (ACC), for the building implementing the security and access measures, shall supply CUPD Access Control Project manager with the information pertaining to the desired theory of operations for the space including population residing within, and the traffic patterns and times of operation therein. If it is determined that the authorized ACC's are failing to comply with policies or misusing the system, their privileges may be revoked.

C. The security system installer is responsible for initial alarm programming and commissioning for intrusion devices with approval and collaboration of Cornell Police Telecommunications and CUPD Crime Prevention.

3.4 TESTING, COMMISSIONING AND ACCEPTANCE

A. A final test of the respective security and card access equipment and hardware shall be performed prior to considering the installation "complete". In the case of a new building or renovation, this shall be done prior to building occupation.

B. As-Builts shall be provided to FMOPS Alarm Group prior to commissioning

C. Installation's project and/or construction manager shall schedule a systems commissioning with the Access Control Project Management team, Security Contractor/Installer, and Electrical contractor, preferable to have the actual installing employee on site if possible, when applicable, two weeks prior to the completion of the installation of a tentative testing date. On that date, a full system test will be performed according to these guidelines.

D. The CUPD Access Control Project Management team will give a commissioning report to the project manager after the test has been completed. When a portion of the system fails during the test, that portion, or the entire system will be tested again. The extent of the retest shall be up to the discretion of Access Control Project Manager.

E. If occupation occurs prior to Access Control commissioning, the Cornell Project Manager is responsible for obtaining CUPD approval and building occupants must be notified of potential security risks (by flier, email via the Unit/College department).

3.5 WARRANTY

A. A warranty shall be provided for labor/workmanship and on hardware included in the installation, for a period of one (1) full year from the date of completion.

3.6 PROJECT CLOSE OUT

A. At completion of the project, the Contractor shall provide the Cornell Project Manager with a complete set of security system "As-Built" drawings that includes, but is not limited to, the following information prior to the closeout of the project. The project manager will ensure these documents are delivered to Facilities Inventory Group for archiving.

1. Head end equipment location and interface panel locations.

2. Power supply locations.

3. Battery calculations.

4. Device locations.

5. Circuit breaker locations: Include power panel and circuit numbers.

6. Complete system riser diagram that depicts all wiring, components, and interconnections. Include locations and labeling

END OF SECTION

SECTION 283102 - ANALOG ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation of a fully operational analog addressable fire alarm system and related Work as described in the Contract Documents.

B. Provide system as approved by local Fire Marshal and the Authority Having Jurisdiction (AHJ). System materials and installation shall be in accordance with the manufacturer's recommendations.

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with NFPA-70 (National Electrical Code), NFPA-72 (National Fire Alarm Code), AHJ, state codes, local codes, requirements of authority having jurisdiction and the contract documents. Installer shall be certified in the State of New York for fire alarm installation.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published UL, NFPA, ANSI, NEMA and IEEE Standards. All system equipment shall be compatible and of the same manufacturer.

D. Each item of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer and shall bear the UL Label.

E. System installation shall be under the supervision of an accredited factory representative. Final connections to the FACP, annunciator panel and any other panels shall be by the factory representative.

F. The system provider must:

1. Provide equipment from a single manufacturer for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years minimum.

3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day, 365 days per year and staff must be adequate to respond within 2 hours of an emergency call.

4. Have a service location not more than 50 miles from the project location.

5. Maintain adequate spare parts inventory to provide both normal and emergency service.

6. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

7. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment

8. Provide all system programming to deliver a customized system to the Owner ready for use.

9. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.

10. Provide a minimum of two system inspections/tests each year during the warranty period as described in NFPA 72. Needed and requested system programming changes shall be provided at these times.

11. Warranty period shall be as described elsewhere with two years being minimum. Provide a service contract for the Owner review for two years beyond the warranty period. Warranty shall include all parts, materials, labor, transportation, etc.

12. Any system being extended or connected to an existing system shall be tested for full functionality prior to beginning work. System shall be signed off by Owner/Engineer as fully functional prior to any new work.

1.3 SYSTEM DESCRIPTION

A. The system shall constantly monitor all initiation devices and notification circuits for any abnormalities or alarm conditions. System shall sample/poll each addressable device no less than every 10 seconds.

B. The system operation subsequent to the alarm activation by any initiating device (manual station, automatic detector, sensor, sprinkler flow switch, etc) shall be as follows:

1. All audible alarm notification appliances within corresponding building or designated area shall provide a common audible fire alarm signal until the System Reset Key or the Signal Silence Key is depressed.

2. All visual alarm notification appliances shall flash continuously and synchronized until the system is reset or silenced.

3. The offsite central monitoring station shall be notified automatically until the System Reset Key or the Signal Silence Key is depressed. The municipal box shall be activated notifying the fire department.

4. Shutdown of the corresponding HVAC system equipment shall occur with a supervisory alarm until the system is reset. All fans over 2000 cfm shall be shut down.

5. Activation of all programmed outputs assigned to the initiating device shall occur until the system is reset or the silence key is depressed.

6. The alarm shall be displayed at the local Fire Alarm Control Panel (FACP) and the fire alarm annunciator panel. A printout shall be produced at the FACP.

7. The system alarm LED shall flash on the control panel and the fire alarm annunciator panel until the alarm has been acknowledged/reset. Once acknowledged, this same LED shall latch on. A subsequent alarm received shall flash the system alarm LED on the control panel and annunciator. The LCD display shall show the new alarm information.

8. A pulsing audible alarm tone shall occur within the local building control panel and, where applicable, the fire alarm annunciator panel until the event has been acknowledged.

9. Alarms shall be entered into the system event log history.

C. Any subsequent alarm shall follow the operation described above.

D. The activation by any system smoke detector or sensor shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within a preset time after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within the prescribed time, the system shall resume normal operation. The alarm verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by device.

E. A manual evacuation (drill) switch shall be provided to operate the alarm notification appliances without causing other control circuits to be activated. However, should an actual alarm occur, all alarm functions shall occur as described previously.

F. The system shall have a password(s) to allow the operator to display all alarms, troubles, and supervisory service conditions log history including the time of each occurrence. This shall be able to be viewed from the front of the control panel, annunciator panel or from a computer connected to the FACP.

G. The actuation of the " walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:

1. The remote central monitoring station connection shall be bypassed.

2. Only audible and visual appliances shall be operated. Other alarm functions (elevator recall, HVAC shutdown, etc.) shall not be affected.

3. Walk test shall be selectable by circuit or circuits.

4. Actual alarms received during a "Walk Test" shall cause the control panel to go into alarm and override the walk test mode.

5. The control panel shall show trouble conditions.

6. The walk test activation of any initiation device shall cause the audible signals to activate for two seconds or a distinguishable audible.

7. The panel shall automatically reset itself after signaling is complete.

8. The control panel shall automatically return to normal condition if there is no activity on a walk test circuit for a period of 30 minutes.

H. Any momentary opening of an initiating or notification appliance circuit wiring shall cause an audible signal to sound at the Fire Alarm Control Panel and, where applicable, the annunciator panel for four seconds indicating a trouble condition.

I. Elevator Operation:

1. Provide the following equipment as a minimum and as indicated on the drawings:

a. Smoke detection in the elevator equipment room.

b. Smoke detection at each elevator lobby.

c. Smoke detection in the elevator shaft if a smoke hatch.

d. Heat detection in the equipment room and shaft (high and low) if a sprinkler system is in the area. Detectors shall be within 2' of the individual sprinkler heads.

e. Detection devices located in elevator lobbies, elevator hoistways and elevator machine rooms shall be used for elevator recall. Hoistway and equipment room heat detection shall initiate power shut down prior to water flow.

Operation shall be in accordance with ASME A17.1, Safety Code for Elevators and Escalators. Signals shall be provided to the elevator controls for main level lobby alarm, any lobby alarm, elevator equipment room alarm and elevator hoistway alarm as a minimum. Provide addressable control modules for the signals to the elevator controls.

J. Alarm initiation of a detector associated with a smoke hatch or fire barrier shall initiate a system alarm. Also, provide connections between the auxiliary contacts on the detectors or addressable control module and the associated smoke hatches and fire barriers such that the smoke hatch or fire barriers will be operated upon its respective detector activation. Provide power supplies, wiring and accessories for fire alarm system and all supervisory functions required for proper smoke hatch and fire barriers operation.

K. Duct mounted smoke detectors associated with duct dampers shall have an addressable control module to operate the duct damper. In the event of an alarm initiation by the duct mounted smoke detector or the associated air handling unit/fan shut down the duct damper shall be closed. Control wiring shall be provided to shut the damper(s) when the associated air handling unit is not operational. Provide power supplies, wiring and accessories as needed for this operation.

L. Provide wiring and equipment such that alarm initiation of a heat detector located in the elevator machine room and/or the elevator shaft shall provide suitable voltage from the fire alarm control panel to be applied to the shunt trip coil of the elevator's supply circuit breaker. No fire alarm devices except the heat detectors in the elevator machine rooms and shaft shall cause this. Also, alarm initiation of these heat detectors shall initiate the system alarm functions described above. Provide an addressable control module with a Form C contact at the elevator controllers, which shall be normally closed and shall open upon alarm initiation of any of these heat detectors; this contact shall be used to disconnect the battery-powered emergency return unit if so equipped with the use of a relay suitable for the emergency power circuit. Also, provide an auxiliary contact on the main line disconnect switch (four pole unit) and two (2) #12 in conduit to the elevator controller from this contact for the same purpose.

M. Provide a minimum of two Form C contacts at the building's fire alarm control panel. This contact shall activate upon activation of any fire alarm initiating device.

1.4 SUPERVISION

A. The system shall utilize independently supervised initiation device circuits. The alarm activation of any initiation device shall not prevent the subsequent alarm operation of any other initiation device.

B. Notification appliance circuits shall be supervised to indicate an open or short circuit condition.

C. The incoming power to the system shall be supervised so that any power failure must be audible and visually indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present. This shall be a trouble alarm.

D. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and the remote annunciator. This shall be a trouble alarm.

E. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.5 SUBMITTALS

A. Provide a complete system submittal prior to ordering of equipment and installation including but not limited to:

1. Complete equipment list, including quantities.

2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.

3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.

4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting, control circuiting and any system applicable building characteristics (ceiling heights, structural members impeding detection, etc). Contact the Engineer for an electronic copy of the project floor plans. Engineer logo shall be included in final drawing.

5. Typical Terminal Wiring Diagram for each type of device.

6. Terminal wiring Diagram for all Fire Alarm equipment.

7. Calculations including:

a. Battery sizing calculations indicating total number of power devices, load associated with each type device, backup period and recommended battery capacity (AH).

b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.

8. Complete console enclosure and equipment configuration.

9. Contractor shall submit copies of the installation firms license for approval and post a copy of license on the premises where the work is being performed.

    a. Work involving installation of Fire Alarm system components shall be performed by firms currently licensed by the NYS department of State Division of Licensing Services. The supervising personnel shall be NICET level 2 certified.

10. Test reports as called for.

11. Copies of the firm alarm installation firm's current license. The contractor shall also post a copy of the license on the premises where work is being performed.

B. If required by the Authority Having Jurisdiction (AHJ) provide a submission of all requested information for review and comment by the AHJ. All AHJ comments shall be incorporated and resubmitted until approved.

C. Test reports at the completion of the project. Testing shall be of all system devices, equipment, circuits, features and functions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The project fire alarm system shall comply with and be in accordance with the drawings and specifications. All system equipment and materials shall be of the same manufacturer unless otherwise indicated. System and component acceptable manufacturers include the following unless otherwise indicated:

1. FCI E3 (Preferred)

2.2 FIRE ALARM SYSTEM

A. The fire alarm system shall be comprised of the components specified as a minimum and also include components not indicated but required for a complete and operable system as described herein.

B. The system and all its components shall be UL listed and in accordance with NFPA 72, local and state codes.

C. The system shall have 25 % spare capacity. This shall include all individual notification circuits, initiation circuits, initiating modules, alarm modules, power supplies, batteries, central processing unit memory and printed circuit card space. System initiation device and control device capacity shall be a minimum of the indicated percentage over the shown quantity or 250 whichever is greater.

D. Each initiating device shall have an individual address for system communication. The system addresses shall not exceed seven digits. Each address, initiation circuit, notification circuit and control point shall have an individual identification description.

2.3 FIRE ALARM CONTROL PANEL (FACP)

A. The system shall be entirely solid state, microprocessor based, use digital transmission and shall be field programmable. All system programming including field modifications shall be stored in non-volatile memory. Field modifications shall be automatically stored without special actions. The panel shall be designed and manufactured expressly for the intent to detect the presence of fire and to provide indication of such detection. Panel shall contain as a minimum power supply(s), control module, main control printed circuit board, initiation modules, notification modules, terminals and back up battery(s). Control module shall have 80 character backlit LCD display and twelve control buttons (four being field assignable), minimum. Display shall indicate the battery voltage at all times.

B. The system shall be modular in design to allow for future expansion with a minimum of hardware additions.

C. The FACP shall be located where shown on the drawings. Enclosures shall accept all system items for an aesthetically suitable operator's console. Enclosures shall be of modular size to allow surface mounting of multiple boxes adjacent to each other, shall have hinged solid metal doors and contain a lock with a key common to all system devices. Enclosure shall have a red finish.

D. Conditions of the system shall be indicated at the operator interface by LED's. These conditions shall be alarm, supervisory, trouble and alarm silenced. An LCD 2 line, 40 character per line display shall also be included. It shall display "SYSTEM IS NORMAL" with the date and time under normal circumstances. The LCD display shall also indicate type of alarm, point status, number of alarms and location. Through the use of function keys, historical data can also be displayed.

E. The FACP shall include a password (three levels of protection with individual passwords, minimum) protected key pad for access to programming, special functions and all system features.

F. Any event initiated by the FACP due to an alarm input shall be retained in nonvolatile EPROM memory. The FACP shall also have sufficient memory for 1200 individual alarm/trouble events.

G. The FACP shall have the following user connection types:

1. Ethernet connection for a computer, personal data device or printer. Connection shall allow for programming changes, history download, setting review/changes, etc.

2. RS 232 port for connection of a serial printer.

H. Provide modules for network interfacing.

I. The FACP shall be equipped with a minimum of 4 hours of battery standby. The FACP shall be equipped with battery charging circuits sufficient to recharge fully depleted batteries to within 70% of the maximum capacity within 12 hours. When the system is operating on the battery supply, a trouble condition shall be generated.
When utility power is restored, the system shall revert back to 120 VAC supply without any operator intervention.

J. Design Equipment: FCI E3

2.4 REMOTE TRANSPONDER UNIT (RTU)

A. The RTU shall function as a subpanel to the FACP, and shall have all the initiation, notification, control, battery, display functions, etc. as the FACP. In the event of failure of the FACP the RTU shall continue to function as a standalone system. All remote notification shall be through the FACP. Provide power circuits to the RTU similar to the FACP. The spare capacity indicated for the FACP shall also be provided in the RTU's. All trouble and alarm conditions at the RTU shall be transmitted to the FACP for suitable operation.

B. RTU's shall contain their own processors and memory and function independently of the FACP but utilize the same base programming. Programming functions in the RTU shall be accessible through the FACP and RTU.

C. The RTU shall be capable of communication with addressable devices that are uniquely identified by an address. Wiring shall be shielded twisted pair cable. The system must allow up to 2,500 feet wire length to the furthest addressable device. T-tapping of the communications channel or multiple loop channels shall be supported.

D. Enclosures shall be of modular size to allow surface mounting of multiple boxes adjacent to each other, shall have hinged solid metal doors and contain a lock with a key common to all system devices.

E. The FACP shall communicate with RTU's through dual supervised data lines. Data lines shall be standard #18 AWG twisted shielded pair minimum or as recommended by the manufacturer. In normal operation, each line shall be used alternately on intervals to maintain line integrity. Should either data line fail, system shall automatically revert to alternate data line and data line trouble shall be reported to operator. The FACP shall automatically "re-boot" after data line is restored. Minimum allowable distance between the FACP and RTU shall be 2500'.

F. Design Make: FCI E3 FACP.

2.5 VENTILATION FAN SHUTDOWN CONTROL

A. Provide supervised normally closed relays and contactors for connection into the fan motor control circuits ahead of all automatic devices.

B. Sequence fan shutdown for every air distribution system. Provide duct detectors in return of systems over 2,000 cfm and in both supply and return at each floor of systems over 15,000 cfm.

C. Provide drill bypass feature, locate switch on Fire Alarm Control Panel and label "DRILL-FAN SHUTDOWN BYPASS". Buzzer shall sound continuously while in bypass mode.

D. Provide fan reset feature, locate switch on Fire Alarm Control Panel and label "FAN RESET".

2.6 INITIATION DEVICES

A. General:

1. Provide analog addressable smoke and thermal sensors as shown. All detectors, control modules, monitor modules and all other initiation devices shall communicate with twisted pair cable and have an individual address. Peripheral devices shall be of the some manufacturer as the FACP.

2. Spot type detectors shall utilize the same interchangeable bases.

3. If a device is removed or taken out of service a trouble signal shall be initiated.

B. Photo-Obscuration Type Smoke Detector:

1. The photo-obscuration detector shall operate on the photo electronic principle and provide an analog signal to the system indicating the amount of smoke. Detector shall be an analog addressable type.

2. The detector shall incorporate a built in type identification so the system can identify the type of detector. The sensor shall be continually monitored to measure any change in their sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). Unit shall not be affected by exterior light or EMF.

3. The detector shall be designed and arranged to prevent interference from exterior electromagnetic fields and light.

4. The detector shall provide advance indication of the analog value of the products of combustion to the FACP indicating that maintenance is required in order to insure normal operation. The detector sensitivity shall be adjustable per device (within UL limits) and be set at the FACP for continuous or variable based on time of day. There shall be a minimum of six selectable sensitivity levels. The individual detector sensitivity setting shall be adjusted to meet the building/space characteristics and operation.

5. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide manufacturer's recommended back box suitable for surface mounting where required.

6. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector to the base with a concealed socket headscrew to prevent unauthorized tampering.

7. Smoke detectors shall be UL 268 listed and FM approved.

8. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise and any Owner requests.
All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

9. Photo-obscuration type smoke detection shall be used for smoke detection unless indicated otherwise indicated.

C. Heat Detector:

1. The heat detector shall be a thermal sensor and shall constantly monitor the space temperature and constantly report this to the system. The unit shall be analog addressable.

2. The sensor shall use dual solid state thermistors and shall monitor the ambient temperature from 32 degrees F, to 155 degrees F and provide a fast response to rapid increase in temperature. The sensor shall send data to the FACP representing the analog value of the ambient temperature. The FACP shall be suitable to monitor for set temperature (selectable by detector for 135 or 155 degrees F) and rate of rise (selectable by detector for 15 or 20 degrees F per minute). Individual detector thermal settings shall be adjusted for the building/space characteristics and operation but shall initially be set to 135 degrees F set temperature and 15 degrees F per minute rate of rise. Shall only be provided to areas prone to physical damage.

3. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide back box suitable for surface mounting where required.

4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket headscrew to prevent unauthorized tampering.

5. Smoke detectors shall be UL 268 listed and FM approved.

6. All thermal sensors shall be field checked and set to meet the prevailing conditions of the premise. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

D. Addressable Initiation Module:

1. The addressable initiation module shall be used to connect supervised conventional initiating device or zone of supervised conventional initiating devices (water flow switches, tamper switches, manual pull stations, (4) wire smoke detectors, conventional (4) wire duct detectors, fire pump alarms, dry chemical fire extinguisher control panels, etc.) to one of the system's addressable circuits.

2. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device.

3. The module shall contain an integral LED that flashes each time the unit is polled.

E. Manual Pull Stations:

1. Non-coded pull-down type, double action (push then pull down) manual addressable units with front keyed test/reset. Units shall be semi-flush where installed in construction with hollow or block walls.

   Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Each unit shall have a distinct address. Units shall be key reset.

2. Units installed outdoors or in potentially wet locations shall be rated for such conditions.

3. Bright red finish with white lettering "FIRE ALARM".

4. Provide tamperproof clear lexan protective shield with speaker and batteries to produce 85 Db minimum sound pressure level at 10 ft. when shield is raised. Shield shall have activation/deactivation switch with lockout screw, and 400 lb. breaking strength retaining cable.

5. Unless directly connected to a central station alarm service, municipal alarm system or local manned fire alarm dispatch station, a clearly legible sign shall be posted above each manual station stating: "LOCAL ALARM ONLY - NOT CONNECTED TO FIRE DEPARTMENT - CALL FIRE DEPARTMENT BY TELEPHONE".

F. Duct-Type Smoke Detector:

1. Detector shall be a photoelectric type that shall be activated by the presence of combustion products.

2. The detector head shall be a plug-in unit. The unit shall contain no moving parts. One chamber shall be for fire detection and the second chamber shall function as a reference, to stabilize the detector for changes in environmental temperature, humidity and pressure. It shall be possible to electrically check detectors sensitivity, using a sensitivity test set, or equivalent, and readjust the detectors sensitivity as required.

3. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket-head screw to prevent unauthorized tampering.

4. Smoke detectors shall be listed by Underwriter's Laboratories, Inc. and approved by Factory Mutual Insurance Company.

5. Provide complete with sampling tubes. Size sampling tubes for 80% of the width of the duct. Locate in ductwork for the indicated system and in accordance with the manufacturer's recommendations.

6. Provide auxiliary contacts and separate 24 VDC power to relay required for smoke damper operation.

7. Provide a remote indicating light/key test switch for each duct detector and mount in nearest corridor ceiling and labeled as to the damper is controlling.

8. Provide addressable base.

9. Duct detector shall report as a supervisory alarm at FACP.

10. Acceptable Manufacturer

    a. Game Well / FCI M/N DNR with 151 remote test station.

G. Projected Beam Photo Electric Smoke Detectors:

1. Microprocessor based beam type smoke detector consisting of two units with projected light beam with measurement of smoke obscuration. Units shall have individual system addresses and a sensing range suitable for the intended location with minimum capability up to 60 ft. x 330 ft. of detection area. Where an analog signal is not available provide an addressable initiation module for system interface.

2. System shall have an adjustable time delay (up to 30 seconds) for momentary beam blockage. Alarm sensitivity shall be adjustable.

3. System lensing shall be selected based on the intended location.

4. Shall initiate trouble alarm when dust obscures beam by 50%. Unit shall compensate for a gradual buildup of dust.

5. Installation with convenient beam alignment adjustments.

6. Provide with manufacturer surface mounting backbox for surface mounted locations.

7. Housing color to match the surrounding colors.

8. Operating voltage 18-32 VDC. Provide a 24 VDC power circuit from the FACP. Connect unit to the system addressable circuit with separate power connection.

9. Provide with remote indicator and testing station for each unit. Station shall indicate system condition (alarm, normal, trouble), have the ability to remotely test the system and have time delay/sensitivity adjustments. Mount station in local utility space and label for the specific unit.

10. Acceptable Manufacturer:

    a. Cornell University Standard UL listed for use with specified fire alarm control panel.

2.7 NOTIFICATION APPLIANCES

A. Speakers:

1. 24 volts DC.

2. Basic grille type with powder coated red finish paint.

3. Speakers shall be rated 94 dBA (anechoic chamer) at 10 feet. Output shall be selectable steady tone or coded. Provide dampening devices to reduce unit output by 5dBA for a minimum of 40% of the system speakers units and install as needed to meet the Owners needs.

4. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box.

5. Units installed outdoors or in potentially wet locations shall be rated for such conditions.

6. Provide directional projector where noted on the Drawings.

7. Provide backbox and grille for fully recessed installations; 4 in. deep box maximum.

B. Strobe Unit:

1. 24 volts DC with built-in Xenon Flasher; two watts maximum. Pulse duration shall be 0.2 seconds with maximum duty cycle of 40%. Illumination intensity shall be field selectable for 15, 30, 75 or 110 candela. Output setting shall be 15 candela in corridors, 75 candela in general areas, 110 candela in sleeping areas or as indicated. Flash rate minimum 1 Hz, maximum 2 Hz. Units within building shall flash in synchronization.

2. Protruding pyramid shaped lexan lens with reflector and the word "FIRE" imprinted on the lens.

3. Rated life shall be a minimum of 500 hours of continuous operation.

4. Units installed outdoors or in potentially wet locations shall be rated for such conditions.

5. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Wall or ceiling mounted as noted on the Drawings.

6. Provide surface backbox for surface installation; 4 in. deep maximum.

C. Combination Speaker-Strobe Units:

1. Unit shall be a combination of the speaker and strobe units specified above in a single manufactured unit.

D. Addressable Notification Appliances:

1. Notification appliances specified herein shall be addressable and individually programmed for use as dictated by the Owner. Notification shall be programmed by floor, office space, common space, specialty use space and others as directed. Appliances shall only annunciate upon the directed conditions and order.

2.8 ADDRESSABLE CONTROL MODULE

A. The addressable control module shall have an individual system address, be supervised and control an output dry contact from indication from the FACP. This can be used to control or have an input to elevator controls, notification appliances, door holder circuits, fans systems, etc. as indicated. Modules shall be connected to the addressable loop(s).

B. The unit shall control an output relay (dry contact form C). The module shall mount in a 4 in. square, 2-1/8 in. deep electrical box.

C. The module shall contain an integral LED that shall flash each time the module is polled.

D. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device. Each unit shall have a separate address and be connected to the system addressable signaling circuit.

2.9 REMOTE ANNUNCIATOR

A. Wall mount within a flush box. Maximum depth of 4 in., stainless steel trim. Nominal dimensions of 4" x 12".

B. Annunciation shall be by two line by 40 character LCD display to provide system information and alarm/trouble description.

C. Unit power and control shall be from the FACP. Unit circuiting shall be supervised.

D. Provide trouble signal with audible buzzer, silencing switch and system reset. All pushbuttons shall be inoperable without key switch activated. Pushbuttons for alarm acknowledge, silence and alarm reset shall be standard on the front with a description. Shall include a minimum of four auxiliary switches/pushbuttons to be programmed as coordinated with the owner (possible options are door holder release override, manual alarm initiation, elevator capture bypass, etc.).

E. Tamper-resistant front panel screws.

F. Provide a framed directory showing the building outline of each floor and referencing device descriptions. All lettering shall be minimum 1/2 in. high. Mount next to remote annunciator.

2.10 BATTERY AND CHARGER

A. Standby power shall be provided through 24 volt DC battery and automatic charger.

B. Provide sealed lead-calcium batteries, ampere-hour capacity which will allow system to operate 24 hours under supervisory condition and at the end of this period to operate all alarm signals for ten consecutive minutes.

C. Provide cell reversal protection.

D. Life expectancy shall be ten years minimum.

E. Charger shall be self-regulating, solid state, type, automatic with capability to fully charge the discharged battery within five hours.

F. Locate charger within the FACP enclosure. Locate batteries in a separate vented enclosure directly adjacent to the FACP.

2.11 PULL STATION ALARM COVER

A. Provide a protective alarm cover over manual pull stations where prone to physical damage. Unit shall allow easy access to the manual pull station and also provide an audible alarm when operated.

B. Unit shall provide a 95dB alarm at 1 foot and be powered from a 9VDC battery.

C. Unit shall be suitable for use in the intended location and pull station.

D. Acceptable manufacturer:

1. System manufacturer.

2. STI Stopper II

2.12 CENTRAL STATION

A. Required points are as follows, but not limited to, (water flow, manual pull, smoke detection, heat detection, special extinguishing systems, and supervisory signals). Provide all necessary programming.

B. Furnish and install a Digitize "Mux Pad" with one 3/4" conduit with pull line and communication cable to communications room and one 3/4" conduit with wiring per manufacturer requirements between FACP and Mux Pad.

PART 3 - EXECUTION

3.1 INSTALLATION, EQUIPMENT

A. All installations shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of Work. Fire alarm installation shall be directed by a person who possesses a state license for installation of fire alarm systems. All equipment and components shall be installed in accordance with the manufacturer's recommendations.

B. System junction boxes and surface mounted device boxes shall be painted red.

C. Provide all wiring to sprinkler flow switches, pressure switches, and alarm check valves, installed by others. Maintain supervisory circuitry to the switches. Use liquidtight conduit for the last 2 ft. - 0 in. of raceway at the switch.

D. Provide all wiring to post indicator valves, OS&Y valves and dry pipe sprinkler system maintenance air pressure switches, provided by others. Wire into the supervisory alarm portion of the fire alarm system.

E. Provide all wiring to the smoke dampers installed by others. Provide an addressable control module for each. Wire to the damper junction box with flexible conduit and wire; provide box or boxes as required. Install according to NEC. Smoke dampers shall close when its associated smoke duct detector is in alarm, upon direction from the FACP or if the associated fan unit is not operating, including manual shutoff of power.

F. Provide all power supplies and wiring to smoke relief hatches and fire barriers provided by others. Smoke relief hatch or fire barrier shall operate only when its associated smoke detector is in alarm.

G. Provide all wiring to duct smoke detectors. Duct smoke detectors shall be mounted on the ventilating ductwork by others. All mounting arrangements, holes cut into ductwork, sealing of openings along with ceiling and access doors for the duct type detectors shall be provided by others. Provide duct detectors along with sampling tubes with end caps. Sequence smoke damper operation thirty seconds after its associated fan has been shut down. Duct detector shall report as supervisory alarm at FACP.

H. Provide all wiring required for fan shutdown. Wire from the addressable control module for each fan to be shut down and provide wiring from the module to the fan control unit (starter, adjustable speed drive, etc.)

Dry contact shall be wired ahead of all control functions for starters. Provide intermediate relay for control circuits beyond the rating of the control module.

I. Provide all wiring for remote test station and status annunciation for a smoke damper.

J. Install all door holders in accordance with installation detail on the drawings and coordinate with the General Construction trade. Connect door holders to nearest 120 volt corridor receptacle circuit.

K. Provide all elevator capture control wiring. Installation shall be in accordance with manufacturer's recommendations.

L. Elevator machine room and shaft heat detectors shall be mounted within two feet of the sprinkler head where applicable.

M. Detection and initiating equipment shall be listed by NRTL and approved by FM.

N. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.

O. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.

P. Install wall mounted audio/visual signal devices at 80 in. AFF to bottom. Where ceiling types are called for, verify ceiling type and mounting height in the field. Provide pendant-mounted devices as required for specified mounting height.

Q. An auxiliary fire alarm relay used to control an emergency control device that provides control functions described in this specification shall be located within 3 ft. of the emergency control device and all wiring shall be supervised.

R. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise. All such Work shall be performed by an authorized representative of the manufacturer trained in such procedures.

S. Provide all wiring at the EP switch. Wire to the EP switch with flexible conduit and wire; provide box or boxes if required. Install according to NEC. Smoke dampers shall operate only when its associated duct smoke duct detector is in alarm.

T. Provide all power supplies and wiring to smoke relief hatched and fire barriers. Smoke relief hatch or fire barrier shall operate only when its associated smoke detector is in alarm.

U. All wiring shall conform to N.E.C. Articles 725 and 760, and to NFPA-72, "National Fire Alarm Code".

V. Label all fire alarm devices and system components (major equipment, conduit, junction boxes and cabling) according to the Cornell Standard 16710 and 283100.

3.2 SYSTEM CIRCUITING

A. Contractor shall attempt to reuse as much exiting wiring as possible throughout the facility. Only replace or provide new when necessary.

B. All wiring shall conform to the NEC, and to NFPA-72, National Fire Alarm Code.

C. Install all wiring in accordance with manufacturer's recommendations taking into account loading, intended location, circuit length, spare capacity and voltage drop.

D. All wiring shall be copper and installed in a dedicated/segregated red EMT conduit system.

E. Power circuits:

1. Provide the required quantity of 20 ampere, 120 volt circuits to the system with a minimum of one for the FACP.

F. Provide minimum #18 AWG twisted shielded pair for addressable signal line circuits. Notification appliance circuits shall be#14AWG minimum.

G. Addressable signal line circuits shall be NFPA 72 2010 Class A (redundant, single open operation).

H. Notification appliance circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).

I. Provide a 24VDC power circuit, #16 twisted pair minimum, with each initiation addressable circuit for the entire length.

J. Notification circuits shall be segregated as indicated on the drawings and by individual floors as a minimum. Circuits shall also be dedicated to audible or visual appliances but not both.

3.3 PROGRAMMING

A. Include in bid the cost to cover all system programming, including items particular to this project (such as custom zone descriptions, time delay settings, sensitivity settings, etc.) such that entire system is 100% complete and operating to the Owner's satisfaction. Coordinate all system programming with the Owner. Also, provide programming of the system a minimum of once during the warranty period to provide changes requested by the Owner.

3.4 SPARE EQUIPMENT

A. Provide the following spare equipment to the Owner. Deliver the equipment to the Owner designated location on the project site in original packaging.

B. Equipment to include:

1. Smoke detectors: 5% of each type used with a minimum of five.

2. Heat detectors: 5% of each type used with a minimum of five.

3. Addressable control modules: 2% of each type used with a minimum of two.

3.5 TESTING AND INSTRUCTION

A. The complete fire alarm system shall be fully tested after the installation is complete. Testing shall include all devices, FACP, annunciator panel, other panels, features and functions. Testing shall be witnessed by the owner's representative, including the Cornell University Fire Marshall's Office and authority having jurisdiction, and be in accordance with the NFPA and herein. Provide a testing report to the authority having jurisdiction and the Engineer as a submittal.

B. Provide a minimum of 2 hours of instruction to the operating personnel designated by the Owner's Representative with regard to use and operation of the system. Provide up to three programming modifications.

C. Provide three sets of keys to all panels, manual stations, etc., to the Owner's Representative.

D. Provide a copy of the system programming to the Owner on a CD/DVD disk or flash drive.

E. Provide to the Owner system Operation Manuals as specified, that shall include as a minimum.

1. Bill of Material.

2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.

3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.

4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting and control circuiting. Contact the Engineer for a copy of the project floor plans.

5. Typical Terminal Wiring Diagram for each type of device.

6. Terminal wiring Diagram for all Fire Alarm equipment.

7. Calculations including:

   a. Battery sizing calculations indicating total number of power devices, load associated with each type device and recommended battery capacity (AH).

   b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.

8. Instruction report starting when instruction was given and who was in attendance, signed by Owner's Representative.

9. A written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved.

10. Certificate of Completion as described in NFPA-72.

11. A two year warranty in accordance with the Basic Requirements of these Specifications shall be provided for this system.

12. All devices shall be pre-tested by the contractor and distributor prior to scheduling final acceptance test with AHJ and EH&S.

13. Final test to be done with AHJ and EH&S present.

3.6 FIRE / SMOKE DAMPER OPERATION

A. Installed Smoke Detection Devices and Smoke Dampers

1. Smoke dampers are installed at each duct/smoke barrier penetration.

2. Every smoke damper has a local duct smoke detector.

3. Every smoke damper has a local remote test station and status annunciation.

4. Every duct smoke detector is addressable and is connected to the building fire alarm system.

5. The building project area is provided with addressable area smoke detectors.

B. Fire Alarm Activation of Smoke Dampers

1. Duct Smoke Detectors:

a. Upon activation of any duct smoke detector, an addressable signal is sent to the building fire alarm system and the smoke damper associated with duct smoke detector is closed.

b. Upon receipt of the addressable duct smoke detector signal, the building fire alarm system shuts down both the supply and return fans or the exhaust fan, associated with the duct system that experienced the detector activation.

c. Upon receipt of the associated fan system drives being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

C. Non-Fire Alarm System Activation of Smoke Dampers (These activations do not cause for a building fire condition to be annunciated)

1. Safety Device Activation

a. Upon activation of either the low-limit switch (freeze-stat) or the supply duct high static pressure switch, both the supply and return fans are de-energized via hardwiring of the low limit switch in the fan starter circuits.

b. The building fire alarm system point addressable module that is installed at the variable frequency drive of the supply and return fans then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated fan system drives being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

2. BMS (Building Management System) Component Fault

a. Upon activation of any of the following BMS component faults, the supply and return fans, or exhaust fan are de-energized via BMS.

1) Supply fan VFD fault

2) Return fan VFD fault

3) Exhaust fan VFD fault

4) Exhaust fan current sensor fault

5) Outside air damper end switch fault

6) Return air damper end switch fault

7) Exhaust air damper end switch fault

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

3. EMCS Operator Activation:

a. When the EMCS system operator overrides the operational status of the air handling system and shuts down the supply, return, or exhaust fans.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

4. Maintenance Operator Activation:

a. When a building maintenance staff member manually shuts off the supply, return or exhaust fan at the starter disconnect switch, the supply, return or exhaust fans are shutdown.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

D. Smoke Damper Testing - M/E Engineering offers the following suggestions for a smoke damper testing protocol. The actual final protocol needs to be authored and approved by all Cornell parties and agencies of interest.

1. Duct Smoke Detector (Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager and Cornell Fire and Safety, apply smoke to any duct smoke detector in the ductwork of any air handling systems which serve the project area.

b. Upon receipt of the addressable duct smoke detector signal, the building fire alarm system shuts down both the supply and return, or exhaust fans associated with the duct system that experienced the detector activation.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

2. Safety Device Activation (Non-Fire Alarm Condition)

a. Under controlled conditions and with proper notification to the Building Manager, manually trip the low limit switch (freeze-stat) associated with any air handling system in the project area.

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

d. Confirm damper closure at the local smoke damper access door.

3. BMS Component Interlock or Fault:

a. Under controlled conditions and with proper notification to the Building Manager, manually cause for a fault condition to occur in any of the following BMS components:

1) Supply fan VFD fault

2) Return fan VFD fault

3) Exhaust fan VFD fault

4) Exhaust fan current sensor fault

5) Outside air damper end switch fault

6) Return air damper end switch fault

7) Exhaust air damper end switch fault

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

d. Confirm damper closure at the local smoke damper access door

4. EMCS Operator Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually override the operational status of any air handling system via laptop, PC or remote access to EMCS Webcontrol and shutdown the associated air handing system.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

5. Maintenance Operator Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually shut off any air handling system within the project area.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

END OF SECTION

System Outputs

System Inputs	**Actuate Common Alarm Signal Indictor**	**Actuate Audible Alarm Signal**	**Actuate Common Supervisory Signal Indicator**	**Activate Audible Supervisory Signal**	**Actuate Common Trouble Signal Indicator**	**Activate Audible Trouble Signal**	**Indicate Zone or Device Description**	**Activate Notification Appliances**	**Display Change of Status on All Annunciators/Printers**	**Transmit Alarm Signal to Central Station**	**Transmit Supervisory Signal to Central Station**	**Transmit Trouble Signal to Central Station**	**Release Magnetically Held Doors**	**Recall Elevator to Recall Floor**	**Actuate Warning to Elevator Controls**	**Actuate Warning to Elevator Cabs**	**Activate Elevators Shunt Trip**	**Close All Related Smoke Dampers**	**Unlock All Exits and Control Doors**	**Shutdown Respective Air Handling Units (SA and RA)**	**Activate Floor Pressurization (High Rise Only)**	**Activate Stairwell Pressurization (High Rise Only)**	**Active Smoke Exhaust (High Rise Only)**	**Open Associated Smoke Hatch**	**Local Notification**
Fire Alarm System AC Power Failure					X	X						X													
Fire Alarm System Low Battery					X	X						X													
Open Circuit					X	X						X													
Ground Fault					X	X						X													
Circuit Short					X	X						X													
Manual Pull Station Actuation	X	X					X	X	X	X			X						X						
Area Smoke Detectors	X	X					X	X	X	X			X	X				X	X		X	X	X		
HVAC Air Duct Smoke Detector			X	X			X		X											X					
Area Heat Detectors	X	X					X	X	X	X			X	X				X	X		X	X	X		
Fire Suppression System Alarm	X	X					X	X	X	X			X	X				X	X						
Sprinkler Tamper Switch			X	X			X				X														
Fire Suppression System Alarm	X	X					X	X	X	X			X	X				X	X						
Sprinkler Water Flow in Building	X	X					X			X			X	X				X	X						
Sprinkler Water Flow in Elevator Equipment Room or Shaft	X	X					X	X	X	X					X	X	X	X							
Elevator Shaft Smoke Detector	X	X					X	X	X	X														X	
Elevator Equipment Room Area Smoke Detector	X	X					X	X	X	X			X	X		X		X	X						
Elevator Shaft and Equipment Room Heat Detectors	X	X	X	X			X	X	X	X			X	X		X	X	X	X						
Elevator Pit Sprinkler Flow	X	X					X			X				X	X	X	X								
Elevator Pit Heat Detector	X	X					X	X		X				X	X	X	X								
Elevator Lobby Smoke Detectors	X	X					X	X	X	X			X	X				X	X		X	X	X		
Elevator Lobby Recall Floor	X	X					X	X	X	X			X	X				X	X		X	X	X		
Fire Pump Power Failure/Phase Reversal			X	X			X		X	X	X	X													
Fire Pump Low Fuel			X	X			X		X	X	X		X	X				X	X						
Fire Pump Running	X	X					X		X	X			X	X				X	X						
Jockey Pump Running			X	X			X		X		X														
Fire Pump not in Automatic Mode	X	X					X			X															
Area of Refuge Two-Way Communication Status	X	X					X			X															
Smoke Detector Adjacent to Smoke Hatch	X	X					X	X	X	X			X	X					X						
AHU Off, Any Reason																		X							
CO Detection			X	X			X		X		X														X

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.02 SUMMARY

A. This Section includes the following:

1. Removal of trees, shrubs, and other vegetation.
2. Removal of root system of trees and shrubs.
3. Topsoil excavation.
4. Demolition and disposal of asphalt concrete pavements.
5. Demolition, removal and abandoning of existing utilities.
6. Pruning operations, Root pruning, Tree protection fencing installation, Mulching, Watering.
7. Temporary chain link fencing and gates.

B. Related Sections include the following:

1. Division 31 Section “Plant and Root Protection” for protection of existing trees and other plants.

1.03 SUBMITTALS

A. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building and site demolition operations.

1.04 MATERIALS OWNERSHIP

A. Except for materials indicated to remain Owner's property, cleared materials become Contractor's property.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable Local and State codes for disposal of debris.

B. Submit to Owner a signed fill agreement or property owner release for deposit of debris material disposed of offsite.

C. Locate, identify, and protect utilities that remain, from damage. Be assured as to the location and position of gas, water, sewer, electric, telephone services and mains, culverts and other conduits that may be affected by the construction and notify the respective authorities in charge of same of the work in the vicinity. CALL Dig Safely New York (former Underground Facilities Protective Organization) 1-800-962-7962 BEFORE STARTING EXCAVATION OPERATIONS. The Contractor will be held strictly responsible for the cost of repairs or replacement of all utilities and other conduits damaged directly by his forces or indirectly by failure to provide proper protection or support of the same. The Contractor will also be held responsible for damages to others caused by utility lines damaged either directly or indirectly by his operations. Comply with all rules and regulations cited in 12 NYCRR 53 - Construction, Excavation and Demolition Operations at or Near Underground Facilities.

1.06 UTILITY INTERRUPTIONS AND CONNECTIONS

A. Coordinate the shutdown details for all utilities with Cornell Utilities Department. A minimum of five (5) working days' notice to the Cornell Utilities Department is required for shutdown scheduling and proper notice to those effected.

B. Water valves will only be operated by Cornell Utilities Department personnel or directly under their supervision.

1.07 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Do not close or obstruct public highways without written authorization from the controlling authority.

B. When road or lane closures are required comply with the requirements of the Manual on Uniform Traffic Control Devices for Streets and Highways, 2009 Edition for barricades and signage

A. Notify the Tompkins County Emergency Control Center at (607)273-7288 at the beginning and end of a restriction on any highway.

B. Schedule work so that all travel lanes in each direction are open when the Contractor's operations are closed down or substantially closed down.

1.08 JOB CONDITIONS

A. Condition of Structure:

1. The Contractor for the work of this Section shall be held to have visited the site, examined the premises, determined for himself the existing conditions, character of equipment and facilities needed for the performance of the work, and all matters which may in any way affect the work before submitting a bid.
   a. Information regarding existing construction or conditions is based on available record drawings, which may or may not truly reflect existing conditions. Such documents are made available on the assumption that they may be of interest to the Contractor, but neither the Architect, Owner nor any of their consultants assumes any responsibility for their accuracy or completeness.
   b. Record drawings of the existing structures are available for review at the office of the Owner. The drawings are for informational purposes only and are not considered part of the construction documents.
   c. Notify the Architect if, during the course of demolition, conditions are discovered which significantly vary from those shown on the contract documents. Do not proceed until authorized by Architect.
2. The Contractor shall accept the condition of the site and structures as found. The Architect and Owner assume no responsibility for condition of site or neither structures nor the continuation of the condition existing at time of bidding or thereafter.

PART 2 - PRODUCTS

2.01 PIPE CAPS AND PLUGS

A. For Water Pipes Abandoned in Place: Ductile iron mechanical joint caps or plugs as specified in Section 331000 – Water Distribution.

B. For All Other Utilities Expandable metal or plastic plug utilizing natural rubber "O" ring with wing nut or hex nut adjustment and suitable for long-term buried applications.

2.02 CHAIN LINK FENCES AND GATES

A. System Description:

1. Galvanized Steel Fence Fabric: 2 inch mesh, 9 gage wire.
2. Fence Height: 8 feet nominal.
3. Line Post Spacing: Spaced equidistant in fence line at intervals not exceeding 10 feet.

B. Steel and Iron Posts: Manufactured in accordance with ASTM A120.

1. Line Posts: 2.375 inch galvanized standard full weight.
2. End, Corner and Pull Posts: 2.875 inch galvanized standard full weight.
3. Gate Posts: 4 inch galvanized standard full weight.

C. Swing Gate: Conforming to ASTM F 900, Schedule 40 galvanized steel frame, welded fabrication. Gate height and fabric to match fence.

1. Double Gate Latch: Drop rod or plunger bar arranged to engage the gate stop. Construct locking device so that the center drop rod or plunger bar cannot be raised when the gate is locked. Latching device to have provision for a padlock.
2. Gate stops.

D. Wire Ties and Tension Wire: Tension wire to meet requirements of ASTM A641, as modified herein. No. 7 gage in diameter; tensile strength at least 80,000 psi with a galvanized coating no less than 0.7 oz. per square foot of surface area. No. 9 gage aluminum wire clips for attaching fence fabric to line posts.

E. Concrete: 2,500 psi; 28-day strength.

PART 3 - EXECUTION

3.01 PREPARATION

A. Site Inspection

1. Prior to work of this Section, carefully inspect the entire site and all objects designated to be removed and to be preserved.
2. Coordinate and complete a walk-through of the site with Landscape Architect prior to site clearing to identify and tag plant life to be protected and preserved.
3. Locate all existing utility lines and determine all requirements for disconnecting and capping.
4. Locate all existing active utility lines traversing the site and determine the requirements for protection.

B. Clarification

1. The drawings do not purport to show all objects existing on the site.
2. Before commencing work of this Section, verify by inspection all objects to be removed and all objects to be preserved.

C. Scheduling

1. Schedule all work in a careful manner with all necessary consideration for neighbors and the public.
2. Avoid interference with the use of, and passage to and from, adjacent buildings and facilities.

D. Disconnection of Utilities: Before starting site operations, disconnect or arrange for the disconnection of all utility services designated to be removed, performing all such work in accordance with the requirements of the utility authority.

E. Protection of Utilities: Preserve in operating condition all active utilities traversing the site and designated to remain.

F. Carefully review clearing work required adjacent to existing structures and subgrade foundations.

3.02 PROTECTION

A. Locate, identify, and protect utilities and existing improvements that remain from damage.

B. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking, or skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Erect and maintain protective fencing for trees and other vegetation.

C. Protect survey benchmarks and property pins from damage or displacement.

D. Conduct site clearing to ensure minimum interference with adjoining roads, driveways, fences and properties.

E. Protect existing above and below grade structures designated to remain from damage. Correct any damage at Contractor’s expense.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Saw-cut limbs and dead under-growth flush to stump on trees that will remain.

C. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.

D. Remove trees and shrubs within site from areas to be further excavated to a depth greater than 12 inches. Remove stumps and main root ball. Carefully grade around trunks and root systems of trees that can remain.

E. Where excavation over 3” in depth or removal of a tree is to occur within the root zone area of a tree to remain, make a clean cut, using a long-handled lopper, hand pruner, or fine-toothed hand saw, in order to minimize disturbance to the undisturbed root zone. The cut shall be a minimum of 2 feet deep, between the designated disturbed and undisturbed root zone area.

3.04 FENCE INSTALLATION

A. Dig or drill 12 inch diameter holes to a depth of 36 inches for corner and gate posts. Set posts plumb and embed in concrete footing.

B. Drive intermediate posts a minimum of 36 inches into earth.

C. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.

D. Position bottom of fabric a minimum of 1 inch and no more than 2 inches above finished grade.

E. Fasten fabric to line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

F. Install bottom tension wire stretched taut between terminal posts.

G. Coordinate pad lock and keying requirements with Local Fire Department.

3.05 SITE DEMOLITION

A. Sawcut all existing asphalt concrete pavements in straight line before removal.

B. Remove, store, and protect scheduled items for reuse.

C. Install and maintain gravel ramps adjoining existing roads.

3.06 BUILDING DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction to a minimum of 12 inches below proposed finish grade.

3.07 REMOVAL

A. Remove surface debris, rocks, trees and shrubs, and excavated stumps and root balls, from site.

3.08 TOPSOIL AND SUBSOIL EXCAVATION

A. Excavate topsoil and subsoil from areas to be further excavated, or re-graded.

B. Stockpile in area designated on site to height not exceeding 10 feet. Surround downgrade perimeter of stockpile with silt fence to protect from erosion. Mechanically seal stockpile to provide free drainage of storm water.

C. Cover stockpile, if necessary, to prevent wind erosion.

D. Remove excess soil not being reused from site.

3.09 SCHEDULE

A. Where indicated on Drawings as “REUSE”, “RESET”, or “RELOCATE”, carefully remove indicated items, clean, and store for reinstallation:

1. Traffic control signs and posts.
2. Exterior light fixtures and poles.

B. Replace all salvaged items damaged by the Contractor at the Contractor’s expense.

3.10 TREE PROTECTION PREPARATION

A. All branch and root pruning and chemical treatment work shall be performed by an arborist, with current certification by the International Society of Arboriculture (ISA).

B. No site preparation work shall begin in areas where tree preservation and treatment measures have not been completed as designated on the drawings and specified herein.

C. List products to be used and firms to perform the work, including their qualifications and ISA certification number.

3.11 ROOT PRUNING

A. Where excavation over 3” in depth or removal of a tree is to occur within the root zone area of a tree to remain, make a clean-cut, using a trenching machine, in order to minimize disturbance to the undisturbed root zone. The cut shall be a minimum of 2 feet deep, between the designated disturbed and undisturbed root zone area.

B. Trench shall be back-filled and compacted immediately with trench soil.

C. Machine to be used for this operation is a vibratory knife (cable puller) capable of a 2 foot deep cut. Blade shall be sharpened prior to use.

3.12 CHEMICAL TREATMENT

A. Only trees affected by construction shall be treated.

B. Chemical Treatment

1. Fertilizer: tree fertilizer with 5:10:10 analysis; supplied by The Doggett Corporation, (800) 448-1862, or equivalent product, subject to approval.
2. Mycorrhizal: by Plant Health Care, Inc. (800) 421-9051, or equivalent product, subject to approval.

C. Injection of a root feeder into the root zone areas of trees shall consist of the following method.

1. Mix fertilizer into solution at rate recommended by manufacturer.
2. Mix mycorrhizal into solution at rate recommended by manufacturer.
3. Inject the root feeder on a 2’ square grid at 7.5 gallons per 100 sq. ft. Injection pressure shall be 100 to 150 psi, as soil conditions warrant. Depth of injection will vary with soil depth, but 18” shall be maximum depth.

4. Root zone area shall be injected, where possible, in the canopy area plus 10’ beyond dripline, but not in root zone loss zones.

3.13 PRUNING

A. Trees to be pruned will include only trees affected by construction.

B. Pruning shall proceed using standard arboricultural procedures and shall provide clearance for vehicular traffic, structures, equipment, tree protection fencing, line-of-sight, or trenching machines during pruning operations. Pruning shall also occur at affected vegetation edge and trees with protective fencing, to remove dead and diseased wood and to cleanly remove any ripped or hanging branches. See plan for scope of work.

C. Chips produced from the trimming operation may be re-spread as mulch in areas of tree root protection. Owner also retains the right of first refusal of chips. If the Owner declines to accept chips, dispose of them legally.

3.14 TREE PROTECTION

A. Tree protection fencing shall be located as shown on the plans. The exact locations will be marked in the field by the Contractor and approved by the Architect prior to installation.

B. No access to fenced areas shall be permitted without prior approval by the Architect. Access for tree maintenance shall be provided into fenced areas with permission by the Architect.

C. Contractor shall provide maintenance and repair of fence during duration of this contract.

3.15 MULCHING

A. Trees within protective fencing and selected trees within high impact areas adjacent to construction shall be mulched at a 4” depth, as shown on the plans.

3.16 WATERING

A. Trees within protective fencing shall be watered on a weekly basis during period of construction. Provide supplemental irrigation so that a minimum of 1” of water per week, including natural precipitation and irrigation, is supplied over entire area within protective fencing. Hoses and irrigation equipment to be supplied by contractor.

END OF SECTION

SECTION 312000 – EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

D. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.02 SUMMARY

A. Section includes:

1. The Work of this Section includes all labor, materials, equipment and services necessary to complete the site earthwork as shown on the drawings and/or specified herein, including but is not necessarily limited to the following:

    a. Layout and staking of all lines and levels.
    b. Protection and safeguards.
    c. Earth open excavation for pavement subgrades.
    d. Trench earth excavation for utilities.
    e. Backfilling utility trenches.
    f. Embankment for pavement subgrades.
    g. Aggregate subbase course for asphalt and concrete pavement.
    h. Disposal of unsuitable and excess excavated materials.
    i. Preparation of sub-grade for walks, pavements and landscape areas to receive topsoil, seeding, and planting.
    j. Dewatering.
    k. Shoring and bracing.
    l. Protection of adjacent existing structures, utilities and other facilities against damage from the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 31 Section "Site Clearing".
2. Division 32 Section "Turf and Grasses”.
3. Division 32 Section "Plants”.

1.03 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

1.04 REFERENCES

A. ASTM D6938 - Test Methods for Density of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. 16 NYCRR Part 753 – Protection of Underground Facilities

C. New York State Department of Transportation - Standard Specifications, Construction and Materials latest edition.

1.05 DEFINITIONS

A. Trench Rock Excavation: Removal of solid mineral material or obstruction that cannot be excavated with a modern track-mounted power shovel equivalent to Caterpillar Model No. 215C LC, and rated at not less than 125 HP flywheel power and 33,075 pound draw-bar pull and equipped with a short stick and 42 inch wide short tip radius rock bucket rated at 0.81 cubic yard capacity. Trenches in excess of 10 feet width are defined as unclassified excavation.

B. Unclassified Excavation: Removal of obstructions visible on the surface, topsoil, earth, and all other subsoil materials encountered that are not defined as trench rock.

C. Subgrade Surface: The undisturbed earth or the compacted soil layer immediately below granular subbase, base of structure, or topsoil materials.

D. Structure: Buildings, foundations, slabs, tanks, manholes, or other constructed or manufactured stationary features occurring above or below ground surface.

E. Utility: Any buried pipe or conduit.

F. Pavement: Any compacted granular, asphalt concrete or portland cement concrete section, either existing or proposed, constructed above the subgrade surface for the purpose of supporting pedestrian or vehicular traffic.

1.06 APPLICABLE STANDARDS

A. American Society for Testing Material (ASTM).

B. All standards shall include the latest additions and amendments as of the date of advertisement for bids.

1.07 REGULATORY REQUIREMENTS

A. SUBMITTALS Submit to Owner a signed fill agreement or property owner release for deposit of any unsuitable and excess excavation materials disposed of off-site.

B. Comply with 29 CFR Part 1926, OSHA, Subpart P, Excavations and Trenches for work of this section.

C. Submit to the University a haul route plan for removal of surplus excavation material. Obtain signed approval from the University and any affected municipalities before commencing off-site hauling activities.

1.08 SUBMITTALS

A. Materials Source: Submit name and address of imported aggregate materials suppliers. Provide materials from same source throughout the Work. Change of source requires Engineer approval.

B. Test Reports: Submit the following reports directly to Owner from the testing services, with copy to Engineer.

1. Analysis of aggregate materials performed in accordance with ASTM C136 and within three months of the submittal date.

1.09 PROJECT CONDITIONS

A. Existing Utilities: Locate, identify, and protect utilities that remain, from damage. Be assured as to the location and position of gas, water, sewer, electric, telephone services and mains, culverts and other conduits that may be affected by the construction and notify the respective authorities in charge of same of the work in the vicinity. CALL Dig Safely New York (former Underground Facilities Protective Organization) 1-800-962-7962 BEFORE STARTING EXCAVATION OPERATIONS. The Contractor will be held strictly responsible for the cost of repairs or replacement of all utilities and other conduits damaged directly by his forces or indirectly by failure to provide proper protection or support of the same. The Contractor will also be held responsible for damages to others caused by utility lines damaged either directly or indirectly by his operations. Comply with all rules and regulations cited in 16 NYCRR Part 753 - Protection of Underground Facilities

B. If uncharted, or incorrectly charted, piping or other utilities are encountered during excavation, consult utility authority and Owner immediately for direction. Cooperate with Owner and utility authority to keep their respective services and facilities in operation.

C. Dust and Sediment Control

1. Use all means necessary to control dust and tracking of sediment on or near the work.
2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and performance of other work on the site.

3. Keep access roads and public roads clear of mud and construction debris at all times. Maintain dust control measures throughout construction. Sweep paved surfaces daily to remove mud and construction debris.

A. Protection

1. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
2. Provide the necessary safeguards to prevent accidents, to avoid all unnecessary hazards and protect the public, the work and the property at all times, including Saturdays, Sundays and holidays.
3. Be responsible for any and all damages which may arise or occur to any party whatsoever by reason of the neglect in providing proper lights, guards, barriers, or any other safeguards to prevent damage to property, life and limb.
4. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

B. Use of explosives is not permitted.

PART 2 - PRODUCTS

2.01 AGGREGATE MATERIALS

A. Structural Fill: Bank-run sand and gravel conforming to the following limits of gradation:

Percent Passing by Weight	Sieve Size
100	4 inch
30 to 95	1/4-inch
10 to 70	No. 40
0 to10	No. 200

B. Granular Fill: Clean Mixture of crushed stone or crushed or uncrushed gravel; ASTM D 1241, Size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 8 sieve.

C. Sub-base Course Material (Type 2): Naturally or artificially graded crushed ledgerock which is sound, durable, and free of organic and other deleterious materials conforming to N.Y.S.D.O.T. Item 733.0402. Material to have 20 percent or less loss after 4 cycles of N.Y.S.D.O.T. Magnesium Sulfate Soundness Test.

D. Bedding Stone: Clean, sound, durable, sharp-angles fragments of rock of uniform quality and conforming to NYSDOT Material Designation 703-0201, Size Designation No. 1 or 1A.

E. Drainage Stone: Clean, sound, durable, sharp-angled fragments of rock of uniform quality and conforming to NYSDOT Material Designation 703-0201, Size Designation No. 2.

A. Pea Gravel: Clean, sound, naturally rounded gravel conforming to the following limits of gradation:

Percent Passing by Weight	Sieve Size
100	1/2-inch
90-100	3/8-inch
0-10	No. 4
0 to 1	No. 200

B. Concrete Sand: Clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances conforming to NYSDOT Material Designation 703-07.

C. Select Fill: Imported or excavated on-site sand, loam, or clay material free from organic material and debris. Unfrozen and containing only small amounts of rock not exceeding four inches in the largest dimension

D. Rip-Rap: Sharp-angled fragments of rock of uniform quality and conforming to NYSDOT Tables 733-21A and -21B, Stone Filling Gradation and Stone Filling Approximate Shape. Nominal spherical dimensions as shown on Drawings.

E. Cushion Sand: Clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances conforming to the following limits of gradation when dry:

Percent Passing by Weight	Sieve Size
100	1/4 inch
0 to 35	No. 50
0 to 10	No. 100

F. Choker Course: Porous concrete pavement choker course materials shall be either AASHTO #57 stone or NYSDOT No. 1 stone - washed.

Percent Passing by Weight	Sieve Size
100	1½ inch
95 to 100	1 Inch
21 to 60	½ inch
0 to 10	No. 4
0 to 5	No.8

G. Infiltration Course: No. 3 Crushed Stone: Washed crushed stone as described in the current NYSDOT Standard Specifications, Section 703 - Aggregates, physical requirements stated therein and the gradation below:

Percent Passing by Weight	Sieve Size
100	2½ inch
90 to 100	2 Inch
35 to 75	1½ inch
0 to 15	1 inch
0 to 5	½ inch

2.02 GEOTEXTILE MATERIALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Amoco Fabrics and Fibers Co.
2. Hoechst Celanese Corp.
3. Nicolon Mirafi Group

B. Separation Fabric: Provide a woven or nonwoven fabric consisting of continuous chain polymeric filaments or yarns of polyester with the following certifiable property values:

Property	Minimum Value	Test Method
Puncture Strength	90 lbs.	ASTM D 6241
Mullen Burst Strength	400 psi	ASTM D 3786
Grab Tensile Strength	200 lbs.	ASTM D 4632
Equivalent Opening Size (sieve)	40	US Std. Sieve

C. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

Property	Value
Puncture Resistance (lb.)	65
Tear Strength (lb)	50
Grab Tensile Strength (lb.)	120
Apparent Opening Size (sieve)	70
Water Flow Rate (gpm/sf)	135

2.03 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying, underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility. Provide tape colors to utilities as follows:

1. Red: Electric
2. Yellow: Gas, oil, steam and dangerous materials
3. Orange: Telephone and other communications
4. Blue: Water systems
5. Green: Sewer systems

B. Tracer Wire: No. 12 THHN Green coated solid copper.

2.04 EROSION AND SEDIMENT CONTROLS

A. Erosion Control Blanket: Flexible, open weave blanket manufactured from photodegradable polypropylene multifilament and tape yarns woven into a dimensionally stable matrix.

B. Stabilized Construction Entrance Aggregate: Clean, sound, durable, sharp-angled fragments of rock of uniform quality and 3 inch nominal spherical dimension.

2.05 SOURCE QUALITY CONTROL

A. Provide and pay for tests and analysis of aggregate material performed in accordance with ASTM C136/C136M-14.

B. If tests indicate materials do not meet specified requirements, change materials and retest.

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum. Layout the Work in accordance with baseline data shown on Drawings.

B. Protect vegetation, lawns, and other features remaining as a portion of final landscaping.

C. Protect all temporary benchmarks, control points, property monuments, existing structures and fences, from excavation equipment and vehicular traffic.

D. Saw-cut existing pavements in straight lines in advance of excavation.

3.02 EXAMINATION

A. Verify that grades and elevations of pavement subgrade are correct prior to requesting proof rolling observation.

B. Provide minimum of 48 hour notice to Owner’s Geotechnical Engineer for proof rolling the pavement subgrade. Verify that Owner’s Geotechnical Engineer has observed proof rolling and that testing agency has completed compaction tests prior to placing aggregate courses.

C. Conduct survey and document conditions of buildings near location of rock removal prior to removal. Photograph existing conditions identifying existing irregularities.

3.03 AGGREGATE STOCKPILING

A. Stockpile earthwork materials on site adjacent to areas of work.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.04 EXCAVATION

A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimension without specific direction of Owner's Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by Owner's Geotechnical Engineer, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Owner's Geotechnical Engineer.
2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classifications, unless otherwise directed by Owner's Geotechnical Engineer.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner's Geotechnical Engineer who will make an inspection of conditions.

1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Owner's Geotechnical Engineer. Excavation of unsuitable material must extend laterally beyond the edge of the footing or slab for a distance equal to or greater than the required depth of the excavation.
2. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

D. Perform excavation with drip line of large trees to remain by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of one (1) diameter and larger with emulsified asphalt tree paint.

E. Rock Excavation:

1. Excavate and remove rock by mechanical method. Utilize hydraulic ramming equipment to fracture rock.
2. Provide uniform surface for placement of structure or utility bedding material.
3. Excavate to 6 inches below pipe barrel invert and a minimum 6 inches beneath outside diameter of bell and spigot pipe joints.
4. Correct areas of utility trench over-excavated with compacted bedding material.

5. Provide bedding material of the type and depth specified for the utility and in accordance with the Drawings.
6. Remove all excavated rock material from the site. Dispose of excavated rock material at a site designated by the Owner.

F. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling. The employment of a Professional Engineer (PE), hired by the Contractor, is required to assess and stabilize all existing conditions prior to demolition.

G. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition.

1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
3. Structurally shore and/or brace any element that is destabilized by adjacent demolition.

H. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations. Maintain water levels below base of excavation to control hydrostatic pressure on subgrade soils.
2. Establish and maintain temporary drainage ditches and other diversion outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. Provide temporary erosion and sediment control.
3. Do not discharge sediment laden water into the adjoining storm or sanitary sewer system or open swales. Pump sediment laden water from excavations into a portable sediment tank or a high-strength, non-woven geotextile fabric bag. Size portable sediment tanks in accordance with the New York Guidelines for Urban Erosion and Sediment Control.

I. Material Storage: Stockpile satisfactory excavated materials where directed until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
2. Dispose of excess soil material and waste materials not re-used.

3.05 OPEN EXCAVATION

A. Excavate topsoil or gravel from areas to be further excavated or re-graded.

B. Stockpile topsoil in area designated on-site to be reused.

C. Excavate subsoil required to accommodate site and roadway grades.

D. Machine slope banks to angle of repose or less, until shored.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Notify Owner's Geotechnical Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

G. Correct areas over-excavated with structural fill.

H. Pile excavated material in manner that will not endanger the Work and that will avoid obstructing drives, temporary ditches or natural water courses, or create erosion or landslide hazards.

I. Remove all excess excavated materials from the site.

3.06 TRENCH EXCAVATION

A. Excavate topsoil or gravel from trench area to be further excavated.

B. Stockpile topsoil to be reused in a designated area on-site.

C. Excavate subsoil to full depth and grade to accommodate the laying of utilities and setting structures.

D. Cut trenches sufficiently wide to enable installation of trench box, shoring, forms, utilities, and to allow inspection. Provide ample trench width to permit placing of fittings and thrust blocking. Maximum and minimum trench width for utilities in accordance with Drawings.

E. Provide uniform surface of solid and undisturbed subgrade for placement of utility or bedding material. Hand trim excavation for bell and spigot pipe joints. Remove loose matter.

F. Excavate to depth required below pipe invert.

G. Remove ledge rock, boulders, and large stones greater than 6 inch diameter, to provide clearance of 6 inches below and 12 inches on each side of all utility pipes and fittings.

H. Correct areas of utility trench over-excavated with compacted structural fill.

I. Provide bedding material of the type and depth specified for the utility and in accordance with the Drawings.

J. Remove all excess excavated materials from the site.

3.07 SITE GRADING

A. General: Uniformly grade areas within project limits including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines: Establish subgrade adjacent to building lines to drain away from structures and to prevent ponding.

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 1-1/2" above or below required subgrade elevations.
2. Pavements: Plus or minus 1/4 inch (13 mm).

3.08 BACKFILLING TRENCHES AND UTILITY STRUCTURES

A. Backfill excavated areas under existing and proposed pavements, including driveways to subgrade elevations with structural fill. Place backfill from top of bedding material to pavement subgrade in maximum 8 inch lifts, each lift compacted at or above 95 percent maximum density.

B. Place drain tile and backfill excavated building foundation trenches with drainage stone to the elevation indicated in the plans. Consolidate stone to eliminate voids by spreading and tamping with a backhoe or using hand tools.

C. Backfill excavated areas adjoining structures up to subgrade elevation with structural fill unless shown otherwise on Drawings. Place backfill in maximum 6 inch lifts, each lift compacted at or above 95 percent maximum density.

D. Backfill excavated areas under lawns or improved areas to topsoil subgrade with select fill. Place backfill from top of bedding material to topsoil subgrade in maximum 12 inch lifts, each lift compacted at or above 92 percent maximum density.

E. Employ placement and compaction methods that do not disturb or damage adjacent work.

F. Maintain optimum moisture content of backfill material to attain required compaction density.

G. Do not backfill with frozen material or where the material already in the excavation is frozen.

H. Remove surplus backfill materials from site.

3.09 EMBANKMENT FOR PROPOSED PAVEMENT SUBGRADE

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than one (1) vertical to four (4) horizontal so that fill material will bond with existing surface.

1. When existing ground surface has a density less than that specified break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to

required depth and percentage of maximum density. Place embankment fill material in maximum 6 inch horizontal lifts. Spread wet embankment fill in 8 inch loose lift and disc to expedite air drying. Remove rock particles larger than 4 inches.

B. Adjust moisture content of embankment fill material to within 2 percent of optimum by either air drying or addition of water prior to compaction.

C. Compact embankment fill with a smooth drum compactor weighing at least 30 tons and operating in the vibratory mode.

3.10 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction[, repeating proof-rolling in direction perpendicular to first direction]. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.11 SUBBASE AND BASE COURSES

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Install soil stabilization fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. Remove rocks and other objectionable material that could puncture the fabric.
2. Place subbase course material over subgrade under hot-mix asphalt pavement.
3. Shape subbase course to required crown elevations and cross-slope grades.
4. Place subbase course 6 inches (150 mm) or less in compacted thickness in a single layer.

5. Place subbase course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.12 AGGREGATE COURSES FOR PAVEMENTS

A. Verify that subgrade has been compacted to specified density and tested prior to placing geotextile.

B. Place separation fabric on prepared subgrade in accordance with manufacturer's instructions. Remove rocks and other objectionable material that could puncture the fabric.

C. Maintain grades, elevations and cross-slopes of aggregate base courses for proposed pavements, as shown on the Drawings.

D. Place aggregate materials in layers of uniform thickness conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base course during placement.

E. Compact aggregate materials with a smooth drum compactor weighing at least 30 tons and operating in the vibratory mode. When a base course is more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

F. Use mechanical tamping equipment in areas inaccessible to drum compactor.

G. Test roll aggregate base course with fully-loaded, ten-wheeled dump truck weighting at least 18 tons prior to placing asphalt or concrete pavements.

3.13 PREPARATION OF SUBGRADE FOR LANDSCAPED AREAS

A. Limit preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum of 4 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots and rubbish,

C. Provide subgrade with an even, smooth surface ready to receive topsoil.

3.14 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698.

1. Pavements: Compact top twelve (12) inches of subgrade and each layer of backfill or fill material to ninety-five (95) percent maximum dry density, at +/- 2% of its optimum moisture content.
2. Landscape areas: Compact top twelve (12) inches of subgrade and each layer of backfill or fill material to eighty-five (85) percent maximum dry density.

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer or soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

a. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing or pulverizing until moisture content is reduced to within + 2% of its optimum moisture content.

3.15 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL

A. Load, remove, and dispose of all unsuitable and excess excavated material. Cover all loads leaving the site and using public highways.

B. Construction debris, trash, and any other objectionable solid waste regulated by 6 NYCRR Part 360, will not be permitted to be buried on the project site.

3.16 TOLERANCES

A. Excavation for Utility Structures and Trenches: Within plus or minus 2 inches.

B. Top Surface of Backfilling: Within plus or minus 1 inch.

C. Top Surface of Aggregate Base Course: Within 1/2 inch. Cross-slope within 1/4 inch when measured with a 10 foot straightedge.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet (30 m) or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

F. Compaction testing of embankment fill, aggregate base course and backfill materials will be performed by Owner's Geotechnical Engineer in accordance with ASTM D698, Standard Proctor.

G. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

H. Seal compacted fill surfaces at the end of each construction day. Slope grade such that surface water will not pond adjacent to original excavation.

I. Provide UL certificate for any repairs made to underground electric service damaged by Contractor operations.

3.18 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath structures, from freezing.

C. Protect, support and maintain all underground and surface structures to remain and other obstructions encountered. Restore structures which may have been disturbed.

D. Encase all existing underground gas, electric, telephone, and cable utilities exposed during construction in cushion sand during backfilling of excavated areas.

E. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

F. Where settling is measurable or observable at excavated areas during warranty period, remove surface, add backfill material, compact and replace surface treatment.

G. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

H. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

I. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

J. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 312001 - BUILDING STRUCTURE EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade.
2. Excavating and backfilling for buildings and structures
3. Drainage course for concrete slabs-on-grade.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures within building footprint.

B. This section pertains to all earthwork performed within the building footprint.

1.03 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches beneath bottom of concrete slabs-on-grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

1.04 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and a cement concrete pavement, slab, walk, or other structure.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

1.06 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows. Dispose of existing soils. Existing soils are NOT permitted to be used for backfill as noted in the geotechnical report by Whitestone dated 2024-08-09.

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

B. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.07 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site.

1.08 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Dig Safe System" for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Selected Fill: Soil material consisting of sound, durable, sand, gravel, stone, and/or blends of these materials, free from organic and other deleterious materials. Comply with the following gradation requirements:

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
4 inch	101.6	100
No. 40	0.425	0-70
No. 200	0.075	0-15

C. Unsatisfactory Soils: Soils not conforming to the material and gradation requirements of Selected Fill.

1. Unsatisfactory soils also include any soil material not maintained within 2 percent of optimum moisture content at time of compaction.

D. Structural Fill: Soil materials conforming to NYSDOT Type 4 subbase material specifications.

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
2 inch	50.8	100
1/4 inch	6.35	30-65
No. 40	0.425	5-40
No. 200	0.075	0-10

E. Subbase Material: Soil material conforming to NYSDOT Type 2 ledge rock subbase material.

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
2 inch	50.8	100
1/4 inch	6.35	25-60
No. 40	0.425	5-40
No. 200	0.075	0-10

F. Cushion Sand: Material consisting of clean, hard, durable, uncoated particles, free from lumps of clay and all deleterious substances and meeting the following gradation requirements of NYSDOT 703-06:

Sieve Size		Percent Passing
Sieve Size	Size opening (mm)	
1/4 inch	6.35	100
No. 60	0.25	0-35
No. 100	0.15	0-10

G. Drainage Course and Coarse Aggregate: Crushed stone conforming to ASTM C33 Blend No. 57 that complies with the material specification requirements of NYSDOT Article 703-02. Alternatively a 50-50 mix of NYSDOT No. 1 and No. 2 stone is acceptable.

Sieve		Percent Passing
Sieve Size	Size opening (mm)	
1 1/2 inch	37.5	100
1 inch	25.0	95-100
½ inch	12.5	25-60
No. 4	4.75	0-10
No. 8	2.36	0-5

2.02 GEOTEXTILES

A. Filter / Separation Fabric Geotextile: Mirafi 160N, Propex 4551, or Geotex 601.

B. Stabilization Fabric Geotextile: Mirafi 500 X, Propex 2002, or Geotex 200ST.

2.03 CONTROLLED LOW-STRENGTH MATERIAL (Only used upon Cornell approval)

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type II.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94/C 94M.
6. Air-Entraining Admixture: ASTM C 260.

B. Produce conventional-weight, controlled low-strength material with 80 to 140 psi compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. Dispose of excavated soils as they are NOT permitted for backfill as noted in the geotechnical report by Whitestone dated 2024-08-09, replace excavated materials with borrow soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.

c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.06 EXCAVATION FOR UTILITY TRENCHES WITHIN BUILDING FOOTPRINT

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.07 SUBGRADE INSPECTION

A. Notify Owner's Representative when excavations have reached required subgrade.

B. If Owner's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted structural fill as directed.

C. Complete bulk excavation within the building footprint to slab-on-grade subgrade elevations. Note that the project may include varying slab elevations. Proof-compact building subgrades within the building footprint with a 10-ton static weight steel drum roller to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction completing (5) overlapping passes in one direction. Repeat this process in a perpendicular direction completing (5) overlapping passes in the opposite direction. Limit vehicle speed to 3 mph. Operate the roller in vibratory mode
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Representative, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Representative, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner's Representative.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner's Representative.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.010 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.011 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with structural fill; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete"

D. Backfill voids with structural fill while removing shoring and bracing.

E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Where approved by the Owner's Representative, place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of structural fill to final subgrade elevation.

H. Controlled Low-Strength Material: Where approved by the Owner's Representative, place final backfill of controlled low-strength material to final subgrade elevation.

I. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.012 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use structural fill.
4. Under building slabs, use structural fill.
5. Under footings and foundations, use structural fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.013 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.014 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, pavements, and utility trenches compact each layer of backfill or fill soil material at 95 percent.
2. Under walkways, compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, compact each layer of backfill or fill soil material at 90 percent.

3.015 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.016 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

4. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

3.017 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place geotextile as detailed on the contract drawings on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 8 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 8 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses with a minimum of two passes of a plate-type vibratory compactor.

3.018 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector / testing agency to perform the following special inspections:

1. Assure prior to placement of fill that site has been prepared in compliance with requirements.
2. Assure that fill material and maximum lift thicknesses comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing

subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner's Representative.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 50 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.019 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Owner's Representative; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.020 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 321216 – ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all Sections of Division 1 – General Requirements which are hereby made a part of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.02 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Pavement markings.

B. Related Sections:

1. Division 31 Section "Earthwork" for aggregate base courses.

1.03 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Formula: From a NYSDOT approved plant, signed by the Regional Materials Engineer with the date of signature not more than two years old. Substitutions or cross outs on the signed JMF will not be accepted.
2. Plant Certification: For each day’s placement, certifying that all materials are in accordance with NYSDOT standards and a total of each mix type delivered to the job site under that contract.

B. Qualification Data: For qualified manufacturer and Installer.

C. Material Certificates: For each paving material, from manufacturer.

D. Material Test Reports: For each paving material.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by NYSDOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NYSDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Uncured or improperly cured slag aggregates have caused serious problems. Delete slag aggregates in remaining paragraphs if not recommended for local use.

C. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

D. Fine Aggregate: ASTM D 1073 sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. In subparagraph below, reduce percentage of natural sand to 10 percent if slow, heavily loaded traffic is anticipated.
2. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

E. Mineral Filler: ASTM D 242 rock or slag dust, hydraulic cement, or other inert material.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: PG 64S-22, meeting requirements of AASHTO M320

1. Use of polyphosphoric acid (PPA) to modify the PG binder properties is prohibited. This prohibition also applies to the use of PPA as a cross linking agent for polymer modification.
2. The mixture designs must be developed in accordance with the criteria specified in the SUPERPAVE Hot Mix Asphalt items that are appropriate for an estimated traffic level of <30 Million 80 kN ESALs.

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.

C. Tack Coat: In accordance with NYSDOT SS Section 407. Diluted to .05-.06 gal/sy for new paving. Diluted to .08-.10 gal/sy for existing HMA and Portland Cement Concrete.

D. Water: Potable.

E. Asphalt Joint Adhesives: Used on all transverse and longitudinal joints for top course in accordance with NYSDOT SS ITEM# 418.7603

2.03 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Binder Course: 19 mm Binder HMA NYSDOT ITEM# 402.197903
3. Top Course: 9.5 mm Top HMA NYSDOT ITEM# 402.097203

2.04 AUXILIARY MATERIALS

A. Pavement-Marking Paint: For all parking spaces, stop bars, and crosswalks within parking lots. Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three minutes.

1. Color: As indicated and as per Cornell University standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Landscape Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.02 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.03 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Revise first two subparagraphs below to suit Project. AI recommends that the minimum compacted thickness of hot-mix asphalt paving lift exceed three times the maximum nominal aggregate size.
   2. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
   3. Place hot-mix asphalt surface course in single lift.
   4. Revise first subparagraph below to higher temperature if thin lifts in cool weather are likely. See National Asphalt Pavement Association recommendations.
   5. Spread mix at minimum temperature of 250 deg F (121 deg C).
   6. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
   7. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.04 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

B. Clean contact surfaces and apply tack coat to joints.

1. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
2. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
3. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
4. Compact asphalt at joints to a density within 2 percent of specified course density.

3.05 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Revise average density and range of acceptable densities in applicable subparagraph below if required. First subparagraph refers to Marshall test method. Revise to Superpave Gyratory Compactor method to verify field compaction if using Superpave method of mix design. Second subparagraph refers to Rice test method preferred by AI.
2. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.06 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).

3.07 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.08 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Asphalt mixtures shall be un accordance with NYSDOT SS 402-3 with the following exceptions and notations:

1. Cornell will provide the Third Party acceptance testing for the pavement density testing by nuclear density gauge. Contractors are encouraged to have their own trained and certified technicians to assure quality and to verify Third Party results.
2. Pavement Density will be verified and accepted by the 70 Series Compaction Methods with all acceptance testing by the Cornell University Third Party Technician. Cornell reserves the right to take pavement cores to test for density in accordance with this

section. Contractors shall work with the University to assure that the requirements of the section are carried out with full cooperation of the paving contractor or subcontractor.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.09 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 321313 – CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.02 SUMMARY

A. Section includes: exterior cement concrete for the following:

1. Exterior cement concrete pavement for walkways.

B. Related Sections include the following:

1. Division 31 Section “Earthwork” for subgrade preparation, grading, and base course.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete pavement mix. Submit proposed concrete design mix together with name and location of batching plant at least 28 days prior to the start of concrete work. Include alternate mix designs (subject to review by Landscape Architect) when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of water to be withheld for later addition at Project site (generally all water shall be added to transit mixer at batch plant).

C. Shop drawings: Submit shop drawings of proposed concrete pavement pattern and layout including expansion joint locations.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials and aggregates.
   a. Provide brand and manufacturer's name
   b. Provide a test performed within the previous month for Alkali-Silica Reaction in aggregates.
2. Form materials and form-release agents.
3. Fiber reinforcement.
4. Steel reinforcement and reinforcement accessories.
5. Admixtures.
6. Sealing compounds.
7. Applied finish materials.
8. Adhesives and epoxies.
9. Joint fillers.
10. Joint-filler strips.
11. Repair materials.
12. ADA detectable warning surface.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source, and each admixture from the same manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Owner to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

H. Pre-installation Conference: Conduct conference at Project site to include Owner, Landscape Architect, General Contractor and Concrete Subcontractor.

1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place are to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixes.
   c. Ready-mix concrete producer.
   d. Concrete subcontractor.
2. Layout of all walkways shall be reviewed to ensure alignments as demonstrated on Contract Documents.
3. Scoring patterns and layout shall be reviewed prior to execution.

I. Fiber reinforcement manufacturer shall provide representative for first placement (pre-pour, on-site, or at ready-mix plant) as required.

1.06 TEST PLACEMENT SECTION

A. Contractor shall prepare a test placement at minimum equal to 10 linear foot of sidewalk at the design width. The purpose of this test placement is to become familiar with the materials, the consistency, admixtures, fibers and other reinforcing, etc. in addition to the finishing requirements which may include consolidating, floating, broom finish, etc.

B. The Test Placement may be included as part of the finished work at the Approval of the Owner's Representative.

C. Subsequent placements shall be staggered such that the test section can be placed and finished to meet the Owner's requirements. Any placement prior to acceptance of the text section may be required to be removed and replaced at the Contractor's expense.

D. Removal of test sections not approved for incorporation into the final work shall be the responsibility of the Contractor.

1.07 DELIVERY STORAGE AND HANDLING

A. Deliver, store and handle steel reinforcement to prevent bending and damage.

1.08 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities and access to the building.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Epoxy-Coated Reinforcement Bars: ASTM A 775; with ASTM A 615, Grade 60, bars.

2.02 FIBER REINFORCEMENT

A. Delete this Article if no fiber reinforcement. Revise if adding polyester or nylon fibers. Monofilament fibers help reduce plastic shrinkage cracking. Manufacturers claim fibrillated fibers also improve hardened concrete properties.

B. Synthetic Fiber: Macro-synthetic fibers shall be manufactured specifically for the reinforcement of concrete and be in accordance with ASTM 1116, Class III. Fibers shall provide temperature and shrinkage reinforcement, provide moderate benefits to reduce cracking, and increase toughness of concrete.

C. Fibers shall be grey color, virgin polypropylene/co-polymer blend, 2" minimum length, and designed for broom finished concrete and be designed to take the place of traditional 6 x 6, W 2.9 W2.9 mesh. Use at minimum 4 pounds / cubic yard. Micro-synthetic and cellulose fibers shall not be permitted. Fiber reinforcement manufacturer shall provide representative for first placement (pre-pour, on-site, or at ready-mix plant) as required.

1. Available Products:
   a. Forta-Ferro by Forta, Grove City, PA, (800) 245-0306, www.forta-ferro.com
   b. ICF M Macro Plus, by ICF Concrete Additives, Warren, NJ (908) 293-8280, www.icfconcreteaddiitves.com
   c. Strux by Grace Construction Products, Cambridge, MA, (877)423-6491, www.gcpat.com
   d. Tuf-Strand by Euclid Chemical Company, Cleveland, OH, (800) 321-7628, www.euclidchemical.com
   e. Approved equivalent.

D. Supplier shall adjust mix at plant to account for changes in slump after addition of fibers, possibly requiring need for water reducers or other admixture to assure workability on the jobsite. Required Water Cement Ratio shall not be changed.

2.03 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

2.04 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, Type I or II.

1. Fly Ash: ASTM C 618, Class F or C.

C. Normal Weight Aggregate: ASTM C 33, uniformly graded, from a single source, as follows:

1. Class: Severe weathering region, but not less than 3S.
2. Nominal Maximum Aggregate Size: 1 inch (38mm) Refer to design mix.
3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more that 18 percent and not less than 10 percent retained on an individual sieve, except that less than 8 percent may be retained on sieves finer than No. 5 (0.3mm).
4. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water: ASTM C 94.

2.05 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Refer to design mixes.

B. Air-Entraining Admixture: ASTM C 260.

C. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

D. Water-Reducing and Retarding Admixture: ASTM C 494, Type A.

2.06 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Cimfilm; Axim Concrete Technologies.
   b. Finishing Aid Concentrate; Burke Group, LLC (The).
   c. Spray-Film; ChemMasters.
   d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
   e. Sure Film; Dayton Superior Corporation.
   f. Eucobar; Euclid Chemical Co.
   g. Vapor Aid; Kaufman Products, Inc.
   h. Lambco Skin; Lambert Corporation.
   i. E-Con; L&M Construction Chemicals, Inc.
   j. Confilm; Master Builders, Inc.
   k. Waterhold; Metalcrete Industries.
   l. Rich Film; Richmond Screw Anchor Co.

m. SikaFilm; Sika Corporation.
n. Finishing Aid; Symons Corporation.

E. Other moisture loss control – for prevention of moisture loss prior to the primary method of curing:
1. "The Bean" - a soybean oil based sealer/water repellant reduces surface color markings from plastic sheeting, enhances strength and durability, but does not reduce porosity.

F. Curing Compound: NOT PERMITTED.

2.07 JOINT SEALANT

A. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Available Products:
a. Crafco Inc.; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.

2.08 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.09 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Dowel alignment system:

1. Products
a. Speed Load PSD1/2x9LT, dowel sleeve in sizes for ½" x 18" dowel bar; by Greenstreak Inc, 800-325-9504, or approved equal.

C. Clear, Waterborne, Membrane-Forming Sealing Compound: ASTM 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, provide one of the following:
a. V-Seal 102 Winter Guard Penetrating Sealer
b. Approved equivalent.

2.10 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

C. Mix Design: W.F. Saunders & Son, Inc. (Tel. 315-469-3217) or approved equivalent. Mix ID: LS51/705 (no water reducer mix)

1. Proportion mixes to provide concrete with the following properties:
   a. Compressive Strength (28 Days): 5000 psi (27.6 MPa).
   b. ESSROC Cement Co. Low Alkali Type I/II Portland Cement: 564 #/CY.
   c. RMS Gravel Inc., Freeville NYSDOT Concrete Sand: 11800 #/CY
   d. Marcellus NYSDOT Limestone : #1's 3/4" (1645 #/CY)
   e. ESSROC Cement Co. Ground Granulated Blast-Furnace Slag: 141 #/CY
   f. Air Entrained: 6% +/- 1.5%.
   g. MasterAir 100 BASF 0.5 oz
   h. Water-Cement Ration Lbs / Lb: 0.41.
   i. Curing: Moist cure for 7 days minimum with burlene or approved equivalent
   j. **Air entrainment dosage to be adjusted for field conditions**

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

F. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 4.0 lb/cu. yd.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94. Furnish batch ticket information to concrete testing representative.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.13 ADA DETECTABLE WARNING SURFACE

A. ADA Detectable Warning Surface: Cast Iron Detectable Warning plate with a non-slip texture on the travel surface. Material used to provide visual warning shall be an integral part of the detectable warning surface. Visual contrast to meet the existing ADAAG A4.2.9.2.

1. Detectable Warning Plate Model R-4984 by Neenah Foundry, 2121 Brooks Avenue, Neenah, WE 54956, (800) 558-5075, www.nfco.com
2. East Jordan, Duralast Panels.

PART 3 - EXECUTION

3.01 PREPARATION

A. Proof-roll prepared base surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted base surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.03 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss on concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.04 REMOVING AND REUSING FORMS

A. General: Formwork that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

B. Leave formwork that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

1. Determine compressive strength of in-place concrete by testing representative field or laboratory cure test specimens according to ACI 301.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Landscape Architect.

3.05 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop or field weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

3.06 JOINTS

A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Install so strength and appearance of concrete is not impaired, at locations indicated or approved by Landscape Architect. Refer to drawings for details. Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.

1. Install epoxy coated dowel bars and plastic dowel sleeves at joints.
2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks, no fewer than 7 days.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Locate expansion joints at intervals of 30 feet, unless otherwise indicated.
2. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
3. Terminate full-width joint-filler strips not less than ½ inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants are indicated.
4. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Slip dowels at expansion joints for load control.

3.07 CONCRETE PLACEMENT FOR WALKS

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.
2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.08 CONCRETE FINISHING FOR WALKS

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium broom finish: Apply nonslip medium broom finish to exterior concrete walks. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom, perpendicular to main traffic route. Coordinate required final finish with Landscape Architect prior to application.

3.09 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. All curing supplies shall be on project site prior to commencement of concrete placement. This shall include identification of water supply, and all curing materials.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including slabs and other surfaces.

D. Commence curing activity as soon as concrete has set to a state where it cannot be easily marred. Conditions may require application of an evaporation retarder to keep surface from drying out during set time. Curing objective shall be to provide constant water supply for concrete hydration through means and methods of the contractor. This shall include a source of clean water available at all times. Avoid concentrated watering that may erode the fresh concrete. If using hydrant water, flush any discolored water prior to hooking up to soaker hoses or sprinkler/mister. Water can be turned off at times during cure as long as it remains wet. Wet cure for 7 days and have personnel available at all times during that period to attend to curing issues that may arise. If curing has to be cut short, due to circumstances and as directed by the University, apply specified cure and seal product on moist concrete to continue curing process for remaining time. Contractor shall submit detailed curing plan prior to planned placement.

E. Cure concrete according to ACI 308.1, by the following method:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.

2. Curing Compound: NOT PERMITTED

3.10 SEALER

A. Exterior Sealer: Apply two (2) coats of specified sealer to exterior concrete slabs, walks, landings, steps, walls, ramps and curbs according to manufacturer's directions. Apply uniformly in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period. If 7 day curing period is not feasible, the VSeal 102 product can be applied to wet or moist concrete in accordance to manufacturer's recommendations.

3.11 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Landscape Architect. Remove and replace concrete that cannot be repaired and patched to Landscape Architect's approval.

B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½ inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Landscape Architect.

C. Perform structural repairs of concrete, subject to Landscape Architect's approval, using epoxy adhesive and patching mortar.

D. Repair materials and installation not specified above may be used, subject to Landscape Architect's approval

3.13 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (9 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch (6 mm).
4. Joint Spacing: 3 inches (75 mm).
5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
6. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change. SLUMP TEST IS ONLY FOR CONSISTENCY, NOT FOR DETERMINATION OF ACCEPTABLE WATER CONTENT.
3. Air Content: ASTM C 231, pressure method, for normal weight concrete; ASTM C173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each type of air-entrained concrete.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
5. Unit Weight: ASTM C567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
6. Compression Test Specimens: ASTM C 31/C 31M; one set of five standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
7. Compressive-Strength Tests: ASTM C 39;
    a. Test two field-cured specimens at 7 days and two at 28 days.
    b. A compressive strength test shall average compressive strength from two specimens obtained from the same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results shall be reported in writing to Landscape Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Landscape Architect but will not be used as sole basis for approval or rejection of concrete.

E. Additional Tests: At Contractor's expense, testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Landscape Architect. Testing agency may

conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed by Landscape Architect.

3.15 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.16 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Landscape Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

E. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 321640 - STONE CURBS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all Sections of Division 01 – General Requirements which are hereby made a part of the Specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.02 SUMMARY

A. This Section includes:

1. Granite curb.
2. Flush granite curb.

B. Related Sections include the following:

1. Division 31 Section “Earthwork” for trenching, bedding, and backfilling.
2. Division 32 Section “Asphalt Paving.”

1.03 SUBMITTALS

A. Product Data: Samples of color and finish.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Provide stone curbing according to the materials, workmanship, and other applicable requirements of the New York State Department of Transportation (NYSDOT) Standard Specifications, Construction and Materials.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Provide stone curbing according to the materials, workmanship, and other applicable requirements of the New York State Department of Transportation (NYSDOT) Standard Specifications, Construction and Materials.

B. Installer Qualifications: Engage an experienced installer who has completed stone curbing installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Single Source Responsibility: Obtain stone curbing from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying progress of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect stone curbing during storage and construction against soiling or contamination from earth and other materials.

B. Protect grout and mortar materials from deterioration by moisture and temperature. Store in a dry location or waterproof container.

1.07 PROJECT CONDITIONS

A. Site Information: Perform site survey and layout for curbing. Verify that straight length, radius, and drop curbing sections may be installed in compliance with drawings and referenced standards.

B. Weather Limitations: Protect mortar material against freezing when ambient air temperature is 40 degrees F and falling. Heat materials and provide temporary protection of completed joints.

C. Sequencing and Scheduling: Coordinate stone curbing work with location and alignment of roadways, parking lot entrances, traffic islands, walks, and drainage inlets.

PART 2 - PRODUCTS

2.01 STONE CURBING

A. Standard Curb: Granite, complying with the requirements of NYSDOT Specifications 714-01 for Type C curb:

1. Size: 5 inches wide by 16 inches deep.
2. Finish: Sawn top, split face battered front.
3. For radii less than 100 feet, radiused curb shall be provided.

B. Concrete Backing and Bedding: Portland cement concrete, 3,000psi mix.

C. Mortar: Cement mortar complying with the requirements of NYSDOT Specifications 705-20.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Do not use stone curbing with cracks, voids, discolorations, and other defects that might be visible in the finished work.

B. Place stone curbing on a continuous concrete backing in accordance with NYSDOT Specifications 609-3.01.

C. Set stone curb on true line and grade to provide a minimum 4- inch and maximum 6-inch reveal above final pavement elevations, and fit no closer than 1/4 inch at the aris line.

D. Fill all joints solid with cement mortar, and remove excess mortar from exposed faces of stone curbing.

E. Backfill, after cement has properly set, with material indicated for applicable pavement section.

F. Saw-cut transition angle from standard face curb to traversable curb per contract documents.

3.02 FIELD QUALITY CONTROL

A. Tolerances: Provide completed stone curbing installation that does not exceed the following deviations from specifications and alignments indicated:

1. Curb Reveal: Plus or minus 3/8 inch.
2. Curb Grade: 1/4 inch per 10 feet.
3. Horizontal Alignment: Within 2 inches.
4. Elevation: Within ½ inch at any point.

3.03 PROTECTION

A. Cleaning: Remove any visible stains and excess mortar from exposed surfaces, wash and scrub clean.

B. Protect the installed curbing from chipping, staining, displacement or other damage during backfilling and paving operations.

END OF SECTION

SECTION 329113 – SOIL PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.02 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for planting soil including, but not limited to the following:

1. Soil preparation for existing protected soils to remain in place.
2. Soil preparation for disturbed in-place soils.
3. Soil preparation for imported soils including testing for conformance.
4. Soil amendments.
5. Deep ripping and decompaction of subgrades.
6. Subgrade percolation testing.
7. Installation and placement of soils.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 31 Section “Site Clearing” for stripping and stockpiling topsoil.
2. Division 32 Section “Earthwork” for excavation, filling, rough grading, and backfill.
3. Division 32 Section “Turf and Grasses” for planting soil mix placement.
4. Division 32 Section “Plants” for planting soil mix placement.

C. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

1.03 REFERENCES

A. ANSI: American National Standards Institute.

B. AOAC: Association of Official Agricultural Chemists.

C. ASA: American Society of Agronomy.

D. ASTM: American Society for Testing Materials.

E. USDA Soil Texture System of Classification.

1.04 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Planting Soil: Stockpiled or imported topsoil and/or subsoil mixed with soil amendments for planting trees, shrubs, ground covers and lawn.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

E. Subsoil: All soil beneath the topsoil layer of the site soil profile, and typified by the lack of organic matter and soil organisms. Subsoil is unsuitable for plant growth unless amended as specified.

F. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

1.05 SUBMITTALS

A. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.

1. Landscape Architect shall reserve the right to reject any soil supplier.
2. Soil mix supplier shall have a minimum of five years' experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone and fax numbers and contact name.
4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

B. Samples: Prior to installing soil mixes, submit representative samples to Landscape Architect for approval. Do not place any soil mixes until Landscape Architect's approval has been obtained.

1. Amended on-site soil mix.
2. Imported sandy loam soil mix.

C. Compost:

1. Product Data: For each type of product indicated, including source.

2. Certificates: Provide certificates required by authorities having jurisdiction, especially for any composted materials containing sewage sludge. Approval as EPA Type 1 “exceptional quality” is required as well as that of the State of New York.
3. Testing: As described in Quality Assurance.

D. All Other Amendments: Product Data.

E. Subgrade Testing:

1. Field percolation test results as described in Part 3 Execution. Percolation tests shall be measured in inches per hour of drainage.

F. Imported Planting Soil Mixes: The following testing is required of all soil mixes comprised of imported soil materials:

1. Particle Size Analysis: Include sand, silt and clay, sand size distribution, sand particle shape, pH, uniformity coefficient by hydrometer method (ASTM D-422-63).
2. Organic Matter: Percent organic matter by combustion (ASTM F-1647, Method 1).
3. Report suitability of soil mixes for turf and plant growth. Verify compliance with recommended quantities of nitrogen, phosphorus, potassium, nutrients and soil amendments to be added to produce satisfactory topsoil.
4. Test results for soil mixes must be accepted prior to placement.

1.06 QUALITY ASSURANCE

A. Source Limitations for Topsoil and Planting Soil Mix: Obtain all topsoil and/or planting soil mix through one source that has been tested according to the requirements below. If there are any additional proposed sources, Contractor must provide topsoil analysis and testing for each source as described below.

B. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.

1. Landscape Architect shall have the right to reject any soil supplier.
2. Soil mix supplier shall have a minimum of five years’ experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone and fax numbers and contact name.

C. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

D. Soil-Testing Laboratory Qualifications: The Contractor shall engage an independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed. The following firms are acceptable testing agencies for the various components:

1. A. McNitt & SerenSoil Testing, LLC
   1338 Deerfield Drive

State College, PA 16803
Tel: 610.360.5985
andy@turfsoiltesting.com

2. Turf & Soil Diagnostics - NY
   35 King Street
   Trumansburg, NY 14886
   855-769-4231
   lab@turfdiag.com
3. Turf & Soil Diagnostics - KS
   613 E. 1st Street
   Linwood, KS 66052
   855-769-4231
   lab@turfdiag.com

E. Qualifications: Proposed planting mix shall be tested by the following:

1. Cornell Nutrient Analysis Lab
   c/o Soil Health Lab
   G01 Bradfield Hall
   306 Tower Rd.
   Ithaca, NY 14853
   soilhealth@cornell.edu
   http://soilhealth.cals.cornell.edu
   607-227-6055

F. Percolation Testing of Subgrade: Prior to placement of the planting soil, test the subgrade as described in this Section. Coordinate the testing of the subgrade for percolation with the Sitework Contractor, Owner's Representative, and Landscape Architect.

1.07 DELIVERY, STORAGE AND HANDLING

A. Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than at field capacity. The Landscape Architect shall be consulted to determine if the soil is too wet to handle.

B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

C. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.

D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.

E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall be placed in mounds less than six feet high. If soil stockpiles greater than six feet high are present longer than two weeks then the contractor shall break down and disperse soil so that mounds do not exceed the six foot height restriction for longer than two weeks.

1. Provide silt fencing around topsoil mounds, and/or as directed in the Storm Water Pollution Prevention Plan (SWPPP).

F. Vehicular access to the site is restricted. The Contractor shall include proposed routing for deliveries and site access in the Soil Management Plan.

G. Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after a heavy rain, nor when frozen. Soil shall be handled only when the moisture content is less than field capacity.

H. Provide delivery tickets for soil amendments to verify the quantity of material specified on the Soil Management Plan. Make corrections and adjustments as directed by the Landscape Architect.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Stockpiled Topsoil: Prior to commencement of Work, the Contractor shall strip and stockpile existing site topsoil for reuse.

1. Screen soil free of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
2. Supplement with imported or manufactured topsoil from off-site sources when on-site quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

B. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; clean and screened free of deleterious materials and weeds, including but not limited to any plant listed by NYSDEC or other authority as invasive, nuisance or noxious weed species; and free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources only if required due to deficit of existing soil materials. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

2.02 ORGANIC SOIL AMENDMENTS

C. Compost: Well-composted, stable, and weed-free organic matter not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by

laboratory tests. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight.

1. Organic Matter Content: 50 to 60 percent of dry weight. (ASTM F-1647, Method 1).
2. The ratio of carbon to nitrogen shall be in the range of 10:1 to 25:1.
3. One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. (ASTM D-422-63).
4. pH: The pH shall be between 5.5 to 7.5 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter. (American Society of Agronomy *Methods of Soil Analysis*, Part 2, 1986).
5. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall not exceed 4.0 mmhos/cm (dS/m).
6. Heavy metal contents shall conform to state and federal regulations.
7. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

D. Compost may be obtained at one of the following sources, provided that the test requirements are met:

1. WeCare Compost by We Care Organics, Jordan, New York, 315-689-1937
2. Cayuga Compost (fine) by P&S Excavating, Trumansburg, New York, 607-387-6826
3. Cornell Farm Services, Ithaca, NY: 607-257-2235
4. CJ Krantz Organics, Clarence Center, NY, 716-741-3850
5. Fessenden Farms, King Ferry, NY, 877-767-7280
6. Approved equivalent.

2.03 SAND

A. Sand: Clean AASHTO M-6 or ASTM C-33 concrete sand.

U.S. Sieve Size No.	% Passing Minimum	% Passing Maximum
¾ in	100	
4	95	100
8	80	100
16	50	85
30	25	60
50	5	30
100	0	10

1. Sand substitutions such as Diabase and Graystone #10 are not acceptable. No calcium carbonated or dolomitic sand substitutions are acceptable. “Rock dust” cannot be substituted for sand.

2.04 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.05 SOIL MIXES, GENERAL

A. All mixes shall meet the following criteria:

1.	Free of stones ½”, stumps, roots and other woody material over 2” in diameter	
2.	Free of brush and seeds from noxious weeds.	
3.	pH	5.5 to 7.2
4.	Soluble salts	<500 ppm

2.06 TURF SOIL MIX

A. Turf soil shall be a loamy sand as defined by USDA Soil Texture System of Classification created from combination of accepted sand, topsoil, and compost meeting the following criteria:

1.	By volume: 3 parts sand 2 parts topsoil 1 part compost	
2.	% passing #270 sieve	11-14%
3.	Uniformity ratio D70/D20	<4.5
4.	Permeability	>4” inch per hour
5.	pH	5.5 to 7.2
6.	Organic Matter	4-5%
7.	Compaction:	86-88% max.

B. Cornell Soil Health Assessment Overall Quality Score of 70 or above, with all sub-indicator test ratings scoring 30 or above.

2.07 PLANTING SOIL MIX

A. Planting soil mix shall be a loam as defined by USDA Soil Texture System of Classification created from combination of accepted sand, topsoil, and compost meeting the following criteria:

1.	By volume: 2 parts sand 1 parts topsoil 2 part compost	
2.	% passing #270 sieve	11-16%
3.	Uniformity ratio D70/D20	<6.0
4.	Permeability	>3” inch per hour
5.	pH	5.5 to 7.2
6.	Organic Matter	6-9%

B. Cornell Soil Health Assessment Overall Quality Score of 70 or above, with all sub-indicator test ratings scoring 30 or above.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting or turf soil mix until all work in adjacent areas is complete and approved by the Landscape Architect.

B. Examination of Subgrade: The subgrade shall be inspected prior to the start of soil placement for conformance with the Drawings for elevations of subgrade relative to finish grade. Subgrade shall be graded smooth and parallel to the finish grades unless otherwise noted in the Drawings.

C. Pre-Grading Inspection: Prior to the commencement of Work, contact the Landscape Architect to provide an inspection to verify the tree root protection zones. Make corrections and adjustments as directed by the Landscape Architect prior to commencing any work.

3.02 SUBGRADE DEEP RIPPING

A. The objective of deep ripping and decompaction is to effectively fracture (vertically and laterally) through the thickness of the physically compressed subsoil material, restoring soil porosity and permeability and aiding infiltration to help reduce runoff.

B. Upon establishment of subgrade elevations for lawn and landscape areas, all subgrade outside of existing tree protection zones shall be deep ripped and decompacted as follows:

1. For the first pass, use a heavy duty, agricultural grade deep ripper or equivalent.
    a. The first series (pattern) of passes is applied lengthwise, parallel with the longest spread of the site; gradually progressing across the site's width, with each successive pass.
2. For the second pass, use a deep subsoiler or equivalent.
    a. The second series runs obliquely, crossing the first series at an angle of about 45 degrees.
    b. In constrained or linear spaces, make broad S-shaped pattern of rips, continually and gradually alternating the S-curves between opposite edges inside the compacted corridor.
3. The third series runs at right angle (or 90 degrees), to the first series to complete the fracturing and shattering on severely compacted sites, and avoid leaving large unbroken blocks of compressed soil material. (In certain instances, the third series may be optional, depending on how thoroughly the first two series loosen the material and eliminate large chunks/blocks of material as verified by tests with a ¾-inch cone penetrometer.)
    a. In constrained or linear spaces, make the third pass of S-shaped rips to continually cross the previous S-pattern along the centerline of the corridor.

C. Resultant fracture of the subgrade shall be 20 to 24 inches deep, as verified by the Owner's Representative. Soil placement shall not occur until depth of fracture is verified and approved by Owner's Representative.

3.03 SUBGRADE DRAINAGE TESTING

A. Perform subgrade percolation testing at a frequency of one percolation test for every 1,000 sq. ft. of installed topsoil area and at all bioretention planting beds. Percolation tests shall be performed on a minimum of 10% of tree pits and 20% of shrub beds, and on any areas of questionable drainage or as required by Landscape Architect. Contact Landscape Architect and conduct percolation tests in his or her presence. Percolation tests shall be measured in inches per hour of drainage at the base of the plant root level.

1. Excavate test pits 36" by 36" by 18" deep.
2. Fill test pit with 12" minimum depth water and allow water to naturally drain out. When water has drained out, fill excavation again with 12" minimum depth water and measure rate of drainage. Drainage rate should be a minimum of 1" per hour (1 inch drop in water elevation per hour test pit).
3. Should any planting areas yield a percolation test result of less than 1" of drainage per hour, stop work on these areas and obtain direction from Landscape Architect prior to installation of planting mixes and amendments.

3.04 MIXING OF SOIL MIXES

A. General Soil Mix Preparation: Examine soil and remove foreign materials, stones over 1/2", and organic debris over 2" in length. All preparation and mixing shall be accomplished when the soil moisture content is less than field capacity.

B. Adequate quantities of mixed planting soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.

1. Minimum depths of mixed soils must be achieved per planting details. Contractor shall remove excess soils from site as needed at no additional cost.

C. Soil mixes shall be produced with equipment that blends together each component in a thorough and uniform manner.

1. Soil mixing can occur in-place or off-site.

3.05 SOIL PREPARATION TECHNIQUES

D. Protection of Existing Soils: Protect existing in-place soils and vegetation.

1. Applicability: All areas within the Project Limit Line that are to remain undisturbed by all construction activities including topsoil stripping, grading, excavation, backfill, staging and stockpiling shall be protected by the following:

a. Enclose area with chain link protection fence. Fence line shall be maintained throughout the duration of the Work.
b. Provide continuous 3" layer of shredded bark mulch at commencement of site work. Layer of mulch shall remain undisturbed throughout the duration of the Work.
c. Upon completion of site work, Contractor shall rototill shredded bark mulch into soil, avoiding tree roots.
d. Contractor shall establish lawn or planting beds as directed in the Landscape Plan.

E. Amendment of Existing Soils: Amend in-place soils and subsoils as follows:

1. Applicability: All areas designated for lawns and planting beds that have been rough graded and/or backfilled shall be treated as follows:

a. Scarify or till subgrade to depth needed to achieve required depth of loose soil mix after amending. Entire surface shall be disturbed by scarification. Do not scarify within drip line of existing trees.
b. Place approved compost directly on existing soil and rototill to thoroughly incorporate at the following ratio:
1) 1/2" of compost for every inch of existing soil (50% by volume).
2) Confirm that depth of loose amended soil meets specified design depths per landscape plan and details.
3) Alternatively, it is the Contractor's option to amend and thoroughly mix excavated existing soils off site and reinstall after scarifying and tilling existing subgrade.
c. Rake beds to fine grade and remove surface rocks larger than 2 inches in diameter.
1) In turf areas, roll to compact soil to 85% of maximum density and remove rocks and debris greater than 1 inch in diameter.

F. Imported Topsoil Mixes: Import topsoil and amend to achieve a sandy loam as defined by the USDA Soil Texture System of Classification.

1. Applicability: All areas designated for lawns and planting beds that need additional material to achieve finish grades.
2. Contractor shall manufacture planting soil mix as follows:
    a. Contractor shall procure all soil component materials.
    b. Contractor shall obtain laboratory testing services to determine percentages of soil component materials required to manufacture planting soil mix.
    c. Mix in fertilizers and amendments as recommended by soil testing laboratory and as approved by the Landscape Architect. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.
    d. After component percentages are determined by the Soil Scientist, each planting soil mix shall be tested for physical and chemical analysis.
    e. Retest mixed planting soil and adjust mix as necessary to meet project requirements.
3. Placement: Scarify or till subgrade to depth needed to achieve required depth of planting or turf soil mix after amending. Entire surface shall be disturbed by scarification. Do not scarify within drip line of existing trees.
4. Rake beds to fine grade and remove surface rocks larger than 2 inches in diameter.
    1) In turf areas, roll to compact soil to 85% of maximum density and remove rocks and debris greater than 1 inch in diameter.

3.06 COORDINATION AND EXCESS MATERIALS

A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to soil placement.

B. Excess Soil Materials: Remove the excess soil materials from the site at no additional cost to the Owner unless otherwise requested.

1. Owner shall reserve right of first refusal on all amended soil mixes.

3.07 FIELD QUALITY CONTROL

C. Post-Installation Inspection: Prior to planting, contact the Landscape Architect to provide an inspection verify that the placement of amendments and soil preparation is consistent with the Soil Management Plan.

1. Contractor and Landscape Architect shall verify depth of planting soil placement and/or rototilled amended soil depth prior to installation of plants.
2. If required depth is not achieved, Contractor shall provide additional rototilling, mixing and compost to achieve specified depth at no cost to the Owner.

D. Provide delivery tickets for soil amendments to verify the quantity of material specified on the Soil Management Plan. Make corrections and adjustments as directed by the Landscape Architect.

END OF SECTION

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the Contract and General Conditions and all sections of Division 01 - General Requirements which are hereby made a part of the specifications.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.02 SUMMARY

A. Section Includes:

1. Seeding.
2. Lawn seed mix.
3. Erosion-control materials.

B. Related Sections:

1. Division 31 Section “Earthwork.”
2. Division 32 Section “Soil Preparation.”

1.03 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Final Acceptance: At the end of Maintenance Period, Landscape Architect shall reinspect all lawn to determine whether Satisfactory Lawn has been achieved.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Initial Acceptance: Completion of seeding, with adequacy determined by Landscape Architect. Maintenance period shall commence for 60 days after initial acceptance, until Final Acceptance.

E. Planting Soil: Stockpiled or imported topsoil mixed with soil amendments for planting trees, shrubs and ground covers.

F. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

G. Subsoil: All soil beneath the topsoil layer of the site soil profile, and typified by the lack of organic matter and soil organisms.

H. Turf Soil: Stockpiled or imported topsoil mixed with soil amendments for establishing seed or sod.

1.04 SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging. Retain subparagraph below for turfgrass sod.

1. Certification of each seed mixture, identifying source, including name and telephone number of supplier.

B. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn and native seed establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
2. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.07 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: March 15 to June 30.
2. Fall Planting: September 1 to November 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.08 MAINTENANCE SERVICE

A. Retain first paragraph below for meadows. Revise minimum maintenance period to suit local customs and growing conditions.

B. Initial Lawn and Native seed Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of planting completion.

a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

PART 2 - PRODUCTS

2.01 TURF MIX A – TRAFFIC/DROUGHT TOLERANT TALL FESCUE MIX

A. Mix is as follows:

Percent	**Type**
30%	Monet Tall Fescue
30%	Cochise IV Tall Fescue
25%	Essential Tall Fescue
10%	Green Supreme Perennial Ryegrass
5%	SR2100 Kentucky Bluegrass

B. Application rate: 10 lb./1,000 sq. ft.

2.02 TOPSOIL | PLANTING MIX | TURF MIX

A. Refer to Section 329113 Soil Preparation.

2.03 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.04 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.05 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.06 EROSION CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

2.07 TEMPORARY LAWN PROTECTION

A. Newly seeded areas shall be protected with 1” x 1” hardwood stakes, single line of double stranded white polypropylene twine drawn four feet (4’) high, no more than ten feet (10’) apart, flagged with 1” wide red weather resistant flag tape. The maximum length of flagging tape shall be four inches (4”).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Decompact subgrade as detailed on drawings. Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Apply fertilizer and amendments as detailed directly to subgrade before loosening.
   2. Thoroughly blend turf soil mix off-site before spreading.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
   3. Spread turf soil mix to a depth as noted in details but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if turf soil or subgrade is frozen, muddy, or excessively wet.
      a. Spread approximately 1/2 the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of turf soil mix.
      b. Reduce elevation of turf soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   2. Loosen surface soil to a depth of at least 6 inches (150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches (150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
      a. Apply fertilizer directly to surface soil before loosening.
   3. Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
   4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.04 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Lawn Preparation" Article.

B. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.05 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 10 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:3 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where shown, installed and anchored according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.06 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic or fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre (15.6-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.07 LAWN MAINTENANCE

A. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

B. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water lawn with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Lawns to a height of 2 to 3 inches (50 to 75 mm).

D. Lawn Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to lawn and native seed areas.

3.08 CLEANUP AND PROTECTION

A. Promptly remove soil and debris, created by work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn and native seed are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

3.09 INSPECTION AND ACCEPTANCE

A. Contractor shall notify Landscape Architect to make inspection of lawn and seeded areas to determine acceptability. Contractor shall provide notification at least 10 working days before requested inspection date. Landscape Architect shall provide letter in writing stating acceptability of lawn and landscape work.

1. Where inspected lawn or native seed does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Remove rejected material and dispose of legally off Owner's property.
2. Lawn may be inspected for acceptance in parts agreeable to Landscape Architect, provided work offered for inspection is complete, including maintenance.

B. Warranty inspection of the entire project will be performed by Landscape Architect at the end of the 1-year warranty period.
1. Use specified materials to reestablish lawns and native seeded areas that do not comply with requirements and continue maintenance until areas are satisfactory.

3.10 SATISFACTORY LAWNS

A. Lawn installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Lawns: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).

B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Trees.
2. Shrubs.
3. Plants.
4. Mulch.

B. Related Sections:

1. Division 31 Section “Site Clearing and Demolition" for tree removal and protection, and tree pruning.
2. Division 31 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Division 32 Section “Soil Preparation” for planting soil mixes.
4. Division 32 Section "Turf and Grasses" for lawn planting.
5. Division 33 Section "Storm Drainage" for below-grade drainage of landscaped areas, paved areas, and wall perimeters.

1.03 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.

D. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.

E. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.

F. Final Acceptance: At the end of the Maintenance Period, Landscape Architect shall reinspect all plantings to determine satisfactory plant establishment.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Initial Acceptance: Completion of planting, with adequacy determined by Landscape Architect. Maintenance period shall commence for 60 days after initial acceptance, and continue until Final Acceptance.

I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

J. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

K. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

L. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

M. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For qualified landscape Installer.

C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis for standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

D. Planting Schedule: Indicating anticipated planting dates for exterior plants.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

F. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

1. Selection of exterior plants purchased under allowances will be made by Landscape Architect, who will tag plants at their place of growth before they are prepared for transplanting.

C. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

D. Observation: Landscape Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

E. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

B. Do not prune trees and shrubs before delivery except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, mulch, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.07 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1 to June 30.
2. Fall Planting: September 1 to November 30.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed according to manufacturer's written instructions and warranty requirements.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Landscape Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.08 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty operation of tree stabilization, edgings, and tree grates.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods from Date of Initial Acceptance:

a. Trees and Shrubs: One year.
b. Ground Cover and Plants: One year.

3. Include the following remedial actions as a minimum:

a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
b. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each exterior plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

1.09 MAINTENANCE SERVICE

A. Initial Maintenance Service for All Plants: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period: 60 days from date of Initial Acceptance.

PART 2 - PRODUCTS

2.01 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Provide trees and shrubs of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

E. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

F. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.02 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

1. Provide balled and burlapped trees.
2. Branching Height: One-third to one-half of tree height.

B. Small Upright Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:

1. Stem Form: As specified.
2. Provide balled and burlapped and container-grown trees.

C. Small Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:

1. Stem Form: As specified.
2. Root: As specified.

2.03 DECIDUOUS SHRUBS

A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

1. Shrub sizes indicated are sizes after pruning.

2.04 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

1. Do not shear.

2.05 PLANTS

A. Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

2.06 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Double ground or shredded bark.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.

1. Inspect planting bed subgrade to verify that subgrade has been fractured, and planting soil mix placed and incorporated fully.
2. Confirm that planting beds are not waterlogged or holding water. Notify Owner’s Representative of any saturated conditions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.03 EXCAVATION FOR TREES AND SHRUBS

A. Planting beds should be backfilled with planting soil mix. Planting soil mix shall be loose and friable.

B. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for all stock.
2. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.

C. Subsoil removed from excavations may not be used as backfill unless amended per Section 329113 Soil Preparation.

D. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes, 24 inches (600 mm) apart, into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.

E. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.04 TREE AND SHRUB PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball 2 inches (50 mm) above adjacent finish grades.

1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Organic Mulching: Apply [2-inch (50-mm)] [3-inch (75-mm)] average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within [3 inches (75 mm)] <Insert measurement> of trunks or stems.

3.05 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character.

3.06 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants as indicated. Review layout with Landscape Architect.

B. Dig holes large enough to allow spreading of roots and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.07 PLANTING BED MULCHING

A. Mulch backfilled surfaces of planting beds and other areas indicated. Provide mulch ring around trees in lawn areas, including all existing trees.

1. Organic Mulch: Apply 4-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.08 PLANT MAINTENANCE

A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

B. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

3.09 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.10 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

B. Owner shall retain right of first refusal on any excess amended planting mixes.

3.11 INSPECTION AND ACCEPTANCE

A. Contractor shall notify Landscape Architect to make inspection of all plantings to determine acceptability. Contractor shall provide notification at least 10 working days before requested inspection date. Landscape Architect shall provide letter in writing stating acceptability of plantings.

1. Where inspected plants not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Remove rejected material and dispose of legally off Owner’s property.
2. Plantings may be inspected for acceptance in parts agreeable to Landscape Architect, provided work offered for inspection is complete, including maintenance.

B. Upon initial acceptance, 60-day maintenance period for all plants shall commence. At end of 60-day period, all plants must be in healthy, vigorous, and otherwise satisfactory condition, as determined by Owner’s Representative and/or Landscape Architect.

C. Final acceptance shall occur at the end of the 60-day maintenance period.

D. Warranty inspection of the entire project will be performed by Landscape Architect at the end of the 1-year warranty period.

1. If any plantings are not satisfactory, include the following remedial actions as a minimum, at no additional cost to the Owner:

a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
b. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each exterior plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

END OF SECTION

SECTION 334200 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 00 & 01 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. Section Includes:

1. PE pipe and fittings.
2. Non-pressure transition couplings.
3. Drains.
4. Manholes.
5. Cast-in-place concrete.
6. Catch basins.
7. Pipe outlets.

1.03 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins: Include plans, elevations, sections, details, frames, covers, and grates.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

1.06 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes in accordance with manufacturer's written rigging instructions.

D. Handle catch basins in accordance with manufacturer's written rigging instructions.

1.08 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Architect and Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 CORRUGATED PE PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.
B. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.
C. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.
D. Corrugated-PE Silt tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.02 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Ring-Type, Flexible Couplings:

1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.03 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.

3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Design Prefabricated Plastic Manholes:

1. Nyloplast structures by ADS or approved equal.
2. Per Construction Plans and Details

D. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 9-inch riser with 4-inch-minimum width flange and 27-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.02 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

   a) Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

   a) Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.03 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.

3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C990, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
9. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C990, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
4. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
5. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 30 by 30 inches minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.04 PIPE OUTLETS

A. Riprap Basins: Broken, irregularly sized and shaped, graded stone in accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-5, screen opening 5 inches.

B. Filter Stone: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
C. Energy Dissipaters: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of micro-tunneling.
F. Install gravity-flow, non-pressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36- inch-minimum cover.
4. Install PE corrugated sewer piping in accordance with ASTM D2321.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non--pressure drainage piping in accordance with the following:

1. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
2. Join dissimilar pipe materials with non-pressure-type flexible couplings.

3.04 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.05 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

3.06 STORMWATER OUTLET INSTALLATION

A. Construct riprap of broken stone, as indicated.
B. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
C. Construct energy dissipaters at outlets, as indicated.

3.07 CONCRETE PLACEMENT

A. Place cast-in-place concrete in accordance with ACI 318.

3.08 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a) Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b) Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.
    a) Unshielded flexible couplings for same or minor difference OD pipes.
    b) Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c) Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.09 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8- inch-thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade in accordance with Section 312000 "Earth Moving."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a) Alignment: Less than full diameter of inside of pipe is visible between structures.

b) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c) Damage: Crushed, broken, cracked, or otherwise damaged piping.
d) Infiltration: Water leakage into piping.
e) Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:

a) Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b) Option: Test plastic piping in accordance with ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.
D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION