RENOVATE VETERINARY MEDICAL CENTER LEVEL 1 FOR SURGE SPACE FOR VETERINARY RESEARCH TOWER

SUCF# 191030

Project Manual & Specifications

June 25, 2026

Owner

Cornell University
Ithaca, New York 14853

Architect

Stantec Architecture, Inc.
61 Commercial Street, Suite 100
Rochester, New York 14614

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A001	GENERAL INFORMATION
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FD100	FIRE PROTECTION DEMOLITION PLAN
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F500	FIRE PROTECTION DETAILS AND SCHEDULES

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FAD-101	FIRST FLOOR - FIRE ALARM DEMOLITION PLAN
FA-101	FIRST FLOOR - FIRE ALARM PLAN
FA-102	FIRST FLOOR - FIRE ALARM PLAN - ADD ALTERNATES
FA-500	FIRE ALARM RISERS

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P000	PLUMBING LEAD SHEET
PD100	PLUMBING UNDERSLAB DEMOLITION PLAN
PD101	PLUMBING FIRST FLOOR SANITARY DEMOLITION PLAN
PD111	PLUMBING FIRST FLOOR SUPPLY WEST DEMOLITION
PD112	PLUMBING FIRST FLOOR SUPPLY EAST DEMOLITION
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P101	PLUMBING FIRST FLOOR SANITARY PLAN
P111	PLUMBING FIRST FLOOR SUPPLY SYSTEMS WEST PLAN
P112	PLUMBING FIRST FLOOR SUPPLY SYSTEMS EAST PLAN
P600	PLUMBING SCHEDULES
P700	PLUMBING DETAILS
P800	PLUMBING RISER DIAGRAMS

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MHD102	MECHANICAL FIRST FLOOR HVAC DEMOLITION PLAN - W
MPD101	MECHANICAL FIRST FLOOR PIPING DEMOLITION PLAN - E
MPD102	MECHANICAL FIRST FLOOR PIPING DEMOLITION PLAN - W
MH101	MECHANICAL FIRST FLOOR HVAC PLAN - E
MH102	MECHANICAL FIRST FLOOR HVAC PLAN - W
MH102A	MECHANICAL FIRST FLOOR HVAC PLAN - ADD ALTERNATE #1
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MH103	MECHANICAL FIRST FLOOR BIOSAFETY CL. & AIRFLOW PLAN
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M804	CONTROLS SCHEMATICS

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E122	1ST FLOOR - LIGHTING CEILING PLAN - ADD ALTERNATES
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E400	ENLARGED PLANS
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E600	ELECTRICAL SCHEDULES
E601	ELECTRICAL SCHEDULES

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TC102	1ST FLOOR - TELECOMMUNICATIONS CONSTRUCTION PLAN ADD/ALT
TC400	TELECOMMUNICATIONS PART PLANS
TC701	TELECOMMUNICATIONS DETAILS SHEET
TC702	TELECOMMUNICATIONS DETAILS SHEET
TC703	TELECOMMUNICATIONS DETAILS SHEET
TC704	TELECOMMUNICATIONS DETAILS SHEET

SECURITY

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TY700	SECURITY DETAILS
TY701	SECURITY DETAILS

END OF DOCUMENT

INSTRUCTIONS TO BIDDERS

Project:	Renovate Veterinary Medical Center Level 1 for Surge Space for Veterinary Research Tower
Owner:	The State University of New York, by Cornell University for and on behalf of the College of Veterinary Medicine Ithaca, New York 14853
Architect:	Stantec Architecture, Inc. 61 Commercial Street, Suite 100 Rochester, New York 14614

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 Veterinary Medical Center Level 1 for Surge Space for Veterinary Research Tower

Submitted by: _____
(Bidder)

b. Proposals shall be delivered to the Owner at the address listed above not later than **2:00PM on December 15, 2026**.

4. BID OPENING

a. Proposals will be opened and read aloud publicly by the Owner in Room 133 Humphreys Service Building, Cornell University Campus, Ithaca, New York and via Zoom at https://cornell.zoom.us/j/99896276734?pwd=o427YbXtLlZubcJetGdN9F2L20JGYY.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 three hundred sixty five (365) 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, November 17, 2026, in Room 133 Humphreys Service Building, or via Zoom at:

https://cornell.zoom.us/j/97103241166?pwd=cbFa2FMCu1XjhjYnVJ2RNlNY5fM9t5.1&from=addon

A pre-bid walkthrough will follow and will meet at Veterinary Medical Center 1st Floor (CVM Loading Dock Area), 930 Campus 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
10. EO 16 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 VETERINARY MEDICAL CENTER LEVEL 1
FOR SURGE SPACE FOR VETERINARY RESEARCH TOWER

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 June 25, 2026, prepared by Stantec Architecture, Inc., 61 Commercial Street, Suite 100, Rochester, New York 14614, 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
ONE	Exterior wall demolition and installation of ten new exterior windows, brick work, etc.	$_____	$_____
TWO	Addition of interior office partitions & finishes	$_____	$_____

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 7.00 % 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 6.08 % 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 three hundred sixty five (365) 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.

DEMOLITION

_____ _____

_____ _____

MASONRY

_____ _____

_____ _____

CARPENTRY

_____ _____

_____ _____

THERMAL & MOISTURE PROTECTION

_____ _____

_____ _____

FLOORING

PAINTING

SIGNAGE

MECHANICAL

FIRE PROTECTION

PLUMBNG

HVAC

ELECTRICAL

COMMUNICATIONS

SECURITY

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	Demolition & Abatement	
Division 03	Concrete	
Division 04	Masonry	
Division 06	Wood, Plastic and Composites	
Division 07	Thermal and Moisture Protection	
Division 08	Openings	
Division 09	Finishes	
Division 10	Specialties	
Division 11	Equipment	
Division 12	Furnishings	
Division 13	Special Construction	
Division 12	Furnishings	
Division 20	General Mechanical	
Division 21	Fire Suppression	
Division 22	Plumbing	
Division 23	HVAC	
Division 26	Electrical	
Division 27	Communications	
Division 28	Electronic Safety and Security	
	Field Order Allowance No. 1	**$218,000**

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. 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:	_____

13. 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
11	EO 16 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 VETERINARY MEDICAL CENTER LEVEL 1
FOR SURGE SPACE FOR VETERINARY RESEARCH TOWER

CORNELL UNIVERSITY
ITHACA, NEW YORK

GENERAL CONDITIONS

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EXHIBITS

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		Construction Contract Change Order Request
		Construction Contract Change Order Summary
B		Final Release
C		Guarantee
D	Form I	MWBE/SDVOB Utilization Plan
	Form II	Summary of Bid Activity with MBE, WBE and SDVOB Subcontractors and Vendors
	Form III	Workforce Report
E		Labor Rate Breakdown
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. 2026030858 dated November 3, 2026. 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 coverages 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 operation's coverages 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 $5,000,000 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.

$ 5,000,000	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. Unmanned Aerial Vehicle (UAV): If Contractor or any of its Subcontractors or agents will operate an Unmanned Aerial Vehicle ("UAV"), a policy of UAV insurance shall be provided on a standard form providing coverage for bodily injury (including death) and property damage on an "occurrence" basis with a combined single limit per occurrence of $2,000,000. This coverage may also be provided by endorsement to the Commercial General Liability policy.

Contractor is responsible to follow the Cornell University UAV Policy, located at: https://www.risk.cornell.edu/events-and-staffing-main-page/use-of-drones/

PDF of Insurance requirements per the above Cornell University Policy: https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/8/4200/files/2016/09/UAV-Guidelines-28wl46t.pdf

8. 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 $5,000,000 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. 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 (Chris Davenport) 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 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.

_____
Corporation or Business Name

Sworn to before me this

_____ Day of _____ 20__ 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** 7.0 % **WBE** 6.08 % **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	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 VETERINARY MEDICAL CENTER LEVEL 1 FOR SURGE SPACE FOR VETERINARY RESEARCH TOWER

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	2026 through 2027
Date Requested	11/03/2026
PRC#	2026030858

Location	Veterinary Medical Center
Project ID#	eB #14283
Project Type	Renovate Veterinary Medical Center Level 1 for Surge Space for Veterinary Research Tower

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 2026 through June 2027. 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

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Cornell University

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

Schedule Year 2026 through 2027
Date Requested 11/03/2026
PRC# 2026030858

Location Veterinary Medical Center
Project ID# eB #14283
Project Type Renovate Veterinary Medical Center Level 1 for Surge Space for Veterinary Research Tower

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

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 a "Request for Wage and Supplement Information" form (PW 39).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 dol.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 dol.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 dol.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. 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.

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.

Contractor Registry (LL 220-I)

Labor Law Section 220-i requires that contractors obtain a Contractor Registry certificate of registration prior to bidding on or commencing work on a public or private project subject to prevailing wage requirements. Subcontractors also are prohibited from commencing work on covered employment unless they have received a Contractor Registry certificate. Contractors are required to submit their Certificate of Registration with their bid materials. A public database is available online to confirm registration at data.ny.gov to confirm registration validity. For additional information on how to register and the requirements, visit https://dol.ny.gov/public-work-contractor-and-subcontractorregistry-
landing.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. Additionally, as per Article 6 of the Labor Law, contractors and subcontractors are required to establish, maintain, and preserve for not less that six (6) years, contemporaneous, 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.

Electronic Certified Payroll (LL 220-J)
Effective December 31, 2025, all contractors and subcontractors who perform public work, or covered private work subject to the prevailing wage, will be required to submit certified payrolls electronically to the Bureau of Public Work and Prevailing Wage Enforcement. Additional information about the electronic certified payroll submission system will be made available on the Department's Website at https://dol.ny.gov/Electronic-Payroll

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. 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. Please Note: Updates to the Wage Schedule shall be made on a quarterly basis.

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.

Shift Work

If the timeline of the contract requires shift work be performed to meet deadlines, the BPWE will enforce the shift work rate as the required rate on the project whether or not shift work is specifically addressed in the contract.

Paid Prenatal Leave

Every employer shall be required to provide to its employees twenty hours of paid prenatal personal leave during any fifty-two week calendar period. Paid prenatal personal leave shall mean leave taken for the health care services received by an employee during their pregnancy or related to such pregnancy, including physical examinations, medical procedures, monitoring and testing, and discussions with a healthcare provider related to the pregnancy. Paid prenatal personal leave may be taken in hourly increments. Benefits for paid prenatal personal leave shall be paid in hourly installments. Employees shall receive compensation at the employee's regular rate of pay, or the applicable minimum wage established by the labor law, whichever is greater, for the use of Paid Prenatal leave.

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 — 11/01/2026

JOB DESCRIPTION Boilermaker **DISTRICT** 7

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

WAGES

Per hour:	07/01/2026	01/01/2027 Additional
Boilermaker	$ 42.50	$ 2.50*

* To be allocated at a later date.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 27.10* + 1.49

*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 a holiday falls 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:

$ 20.09* + 1.49	$ 20.09* + 1.49	$ 21.09* + 1.49	$ 22.08* + 1.49	$ 23.07* + 1.49	$ 24.09* + 1.49	$ 25.11* + 1.49	$ 26.10* + 1.49

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

7-175

Broadband — 11/01/2026

JOB DESCRIPTION Broadband **DISTRICT** 4

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, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES
Orange: Only in the Village of Greenwood Lake, Village of Highland Falls, Town of Tuxedo, and Town of Patterson

WAGES
NOTE: Applies to all public work and covered private projects, including those receiving ConnectAll funding subject to New York State Labor Law §224-E, solicited on or after July 1,2025. For all other projects solicited prior to July 1,2025 please see LINEMAN ELECTRICIAN(1)-TELEDATA

Per Hour:	07/01/2026	08/04/2026
Field Tech Install/Repair*	$ 52.85	$ 54.44

For outside work (excluding installation on building construction/alteration/renovation projects), stopping at first point of attachment (demarcation), installing/maintaining/repairing broadband internet service.

"Broadband", "Broadband Service", or "Broadband Internet" means mass-market retail service by wire or radio that provides the capability to transmit data to and receive data from all or substantially all internet endpoints, including any capabilities that are incidental to and enable the operation of the communications service, but excluding dial-up internet access service.

*NOTE: EXCLUDES work within ten(10) feet of High Voltage (600 Volts and over) transmission lines. Please see LINEMAN rates.
*NOTE: Does not include the operation of equipment. Please see applicable OPERATING ENGINEER rates.
*NOTE: Does not include Groundmen/Flagger/Flagmen. Please see LABORER/LABORER-HEAVY/HIGHWAY rates.

SUPPLEMENTAL BENEFITS
Per Hour:

$ 23.24

OVERTIME PAY
See (B, K, *R) on OVERTIME PAGE
* Two and one half times the hourly rate after the 8th hour

HOLIDAY
Paid: See (5, 6, 7, 11, 12) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 12) on HOLIDAY PAGE

4-CWA-Dist2

Carpenter - Building — 11/01/2026

JOB DESCRIPTION Carpenter - Building **DISTRICT** 2

ENTIRE COUNTIES
Chemung, Cortland, Schuyler, Steuben, Tompkins

PARTIAL COUNTIES
Allegany: Only the Township of Alfred.

WAGES

Per hour:	07/01/2026	07/01/2027 Additional	07/01/2028 Additional
Carpenter	$ 35.09	$ 4.00*	$3.00*
Floor Coverer	35.09	4.00*	3.00*
Carpet Layer	35.09	4.00*	3.00*
Dry-Wall	35.09	4.00*	3.00*
Diver-Wet Day	61.25	4.00*	3.00*
Diver -Dry Day	36.09	4.00*	3.00*
Diver Tender	36.09	4.00*	3.00*

*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 $3.00 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 thier 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 10% of base wage per hour
3rd Shift - Premium of 15% 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:

	07/01/2026
Journeyworker	$ 23.89

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:

$ 13.05	$ 13.05	$ 15.65	$ 15.65

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 $3.00 per hour over the apprentices rate of pay when the apprentice is required to be certified and performs DOT, AWS 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 their regular hourly rate plus $1.50 per hour.

2-277B-CS

Carpenter - Building / Heavy&Highway — 11/01/2026

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:	07/01/2026	07/01/2027 Additional
Carpenter - ONLY for Artificial Turf/Synthetic Sport Surface	$ 39.69	$ 2.25*

*To be allocated at a later date.

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

SUPPLEMENTAL BENEFITS
Per hour worked:

Journeyworker	$ 27.84

OVERTIME PAY
See (B, E, Q) 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 worked:

$ 19.08	$ 19.69	$ 21.86	$ 22.47

2-42AtSS

Carpenter - Heavy&Highway 11/01/2026

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	07/01/2026	07/01/2027 Additional
Carpenter	$ 41.02	$ 4.42*
Piledriver	41.02	4.42*
Dockbuilder	41.02	4.42*
Diver-Wet Day	66.02	4.42*
Diver-Dry Day	42.02	4.42*
Diver-Tender	42.02	4.42*

*To be allocated at a later date.

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 $5.00 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 $0.50 per foot
  101' to 150' additional $0.75 per foot
  151' to 200' additional $1.25 per foot
  201' and deeper additional $1.50 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 $0.75 per foot
  101' to 200' additional $1.00 per foot
  Over 201' additional $1.25 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 $4.00 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	$ 27.81

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
CARPENTER/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:			
$ 19.05	$ 19.66	$ 21.78	$ 22.39

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 $5.00 per hour.

2-277HH-Bro

Electrician 11/01/2026

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:	07/01/2026
Electrician	$ 54.00
Teledata	54.00
Cable Splicer	59.40

NOTE: Additional amounts, subject to overtime premiums, due for the following work (applicable to all employees):
- 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. Also applies to working from mechanical lifts when used above 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 AM and 4:30 PM 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 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 (dayshift + 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	8:00 AM - 4:30 PM:	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	$ 35.58 plus 3% of hourly wage paid*

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

1st period (0-1000 hrs)	$ 21.60
2nd period (1001-2000)	24.30
3rd period (2001-3500)	27.00
4th period (3501-5000)	32.40
5th period (5001-6500)	37.80
6th Period (6501-8000)	43.20

SUPPLEMENTAL BENEFITS per hour:

1st period	$ 15.50*
2nd period	15.50*
3rd period	31.58*
4th period	32.38*
5th period	33.18*
6th period	33.98*

*NOTE: Plus 3% of hourly wage paid, straight time rate or premium time rate.

6-43

Electrician — 11/01/2026

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:	07/01/2026	06/01/2027 Additional
Electrician	$ 47.00	$ 4.50*

* To be allocated at a later date.

NOTE: Additional amounts, subject to overtime premiums, due for the following work (applicable to all employees):
-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.

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	$ 32.23 plus 3% of hourly wage paid*

*NOTE: The 3% is based on the hourly wage paid, straight time rate or premium time 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	50%
2nd year	55%
3rd year	65%
4th year	75%
5th year	85%

SUPPLEMENTAL BENEFITS per hour:

1st year	$ 14.93*
2nd year	14.93*
3rd year	25.63*
4th year	27.27*
5th year	27.92*

*NOTE: Plus 3% of hourly wage paid, straight time rate or premium time rate.

6-241

Elevator Constructor — 11/01/2026

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:	07/01/2026	01/01/2027
Mechanic	$ 60.99	$ 63.706
Mechanic Helper	42.69	44.594

SUPPLEMENTAL BENEFITS

Per hour:		
Journeyworker	$ 38.985*	39.535*

*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 Mechanic 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 regular hourly apprentice rate paid, no additional supplemental benefits.

All other terms: Same as Journeyworker

6-62.1

Glazier — 11/01/2026

JOB DESCRIPTION Glazier **DISTRICT** 5

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

WAGES
Per hour: 07/01/2026

Glazier	$ 33.00

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 34.15

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	$ 21.00
Appr. 2nd term	22.00
Appr. 3rd term	23.00
Appr. 4th term	24.00
Appr. 5th term	25.00
Appr. 6th term	26.00
Appr. 7th term	27.00
Appr. 8th term	28.00

Supplemental Benefits per hour:

Appr. 1st term	$ 13.27
Appr. 2nd term	13.27
Appr. 3rd term	19.27
Appr. 4th term	19.27
Appr. 5th term	20.27
Appr. 6th term	20.27
Appr. 7th term	21.27
Appr. 8th term	21.27

5-677z3

Insulator - Heat & Frost — 11/01/2026

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:	07/01/2026	05/01/2027 Additional	05/01/2028 Additional	05/01/2029 Additional
ON MECHANICAL SYSTEMS ONLY:				
Asbestos Worker	$ 45.75	$ 4.50*	$ 4.75*	$ 6.25*
Insulation Installer	45.75	4.50*	4.75*	6.25*
Firestopping Worker	45.75	4.50*	4.75*	6.25*

* To be allocated at a later date.

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

1st Shift	$ 45.75
2nd Shift	52.61
3rd Shift	54.90

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 28.59

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%

SUPPLEMENTAL BENEFITS per hour:

$ 24.24	$ 24.24	$ 28.59	$ 28.59

7-30-Syracuse

Ironworker — 11/01/2026

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: 07/01/2026

Ironworker	$ 38.50

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

1st Shift	Regular wage rate
2nd Shift	Regular wage rate plus 10% - Starting times between 2 PM and 7 PM
3rd Shift	Regular wage rate plus 15% - Starting times between 7 PM and 12 AM

NOTE: When a single irregular shift is worked, with start times based on second or third shifts, add 10% to the 1st shift wage rate posted above.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 33.30

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	$ 13.28
2nd year	21.82
3rd year	23.04
4th year	24.26

6-60

Laborer - Building — 11/01/2026

JOB DESCRIPTION Laborer - Building **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 #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

	07/01/2026
GROUP #1	$ 31.25
GROUP #2	32.25
GROUP #3	33.25
GROUP #4	33.25

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	$ 20.20

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

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
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	$ 15.85
2nd term	17.10
3rd term	17.98
4th term	18.85

2-785b

Laborer - Heavy&Highway 11/01/2026

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.

	07/01/2026	07/01/2027 Additional
GROUP A	$ 39.80	$ 4.20*
GROUP B	40.00	4.20*
GROUP C	40.20	4.20*
GROUP D	40.40	4.20*
GROUP E	45.00	4.20*

*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".

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 $5.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 28.01

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%	90%	95%

SUPPLEMENTAL BENEFITS per hour:
All terms $ 28.01

2-785h

Laborer - Tunnel 11/01/2026

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.

	07/01/2026	07/01/2027 Additional
Group A	$ 42.98	$ 4.20*
Group B	43.18	4.20*
Group C	47.98	4.20*
Group D	47.98	4.20*

*To be allocated at a later date

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 $5.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 28.01

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%	90%	95%

SUPPLEMENTAL BENEFITS per hour:

All Terms $ 28.01

2-785T

Lineman Electrician — 11/01/2026

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:	07/01/2026	05/03/2027	05/01/2028
Group A:			
Lineman, Technician	$ 64.37	$ 66.84	$ 69.47
Crane, Crawler Backhoe	64.37	66.84	69.47
Welder, Cable Splicer	64.37	66.84	69.47
Group B:			
Digging Mach. Operator	$ 57.93	$ 60.16	$ 62.52
Group C:			
Tractor Trailer Driver	$ 54.71	$ 56.81	$ 59.05
Groundman, Truck Driver	51.50	53.47	55.58
Equipment Mechanic	51.50	53.47	55.58
Group D:			
Flagger	$ 35.40	$ 36.76	$ 38.21

Additional 3% per hour above regular rate for entire crew when a helicopter is used. This will increase to 5% on May 03, 2027.

-----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	$ 64.37	$ 66.84	$ 69.47
Crane, Crawler Backhoe	64.37	66.84	69.47
Cable Splicer	70.81	73.52	76.42
Certified Welder, Pipe Type Cable	$ 67.59	$ 70.18	$ 72.94
Group B:			
Digging Mach. Operator	$ 57.93	$ 60.16	$ 62.52
Group C:			
Tractor Trailer Driver	$ 54.71	$ 56.81	$ 59.05

Groundman, Truck Driver	51.50	53.47	55.58
Equipment Mechanic	51.50	53.47	55.58
Group D:			
Flagger	$ 35.40	$ 36.76	$ 38.12

Additional 3% per hour above regular rate for entire crew when a helicopter is used. This will increase to 5% on May 03, 2027.

-----Below rates applicable on all railroad catenary installation and 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	$ 65.81	$ 68.34	$ 71.03
Crane, Crawler Backhoe	65.81	68.34	71.03
Cable Splicer	72.39	75.17	78.13
Certified Welder,			
Pipe Type Cable	69.10	71.76	74.58
Group B:			
Digging Mach. Operator	$ 59.23	$ 61.51	$ 63.93
Group C:			
Tractor Trailer Driver	$ 55.94	$ 58.09	$ 60.38
Groundman, Truck Driver	52.65	54.67	56.82
Equipment Mechanic	52.65	54.67	56.82
Group D:			
Flagger	$ 36.20	$ 37.59	$ 39.07

Additional 3% per hour above regular rate for entire crew when a helicopter is used. This will increase to 5% on May 03, 2027.

-----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	$ 67.10	$ 69.68	$ 72.43
Crane, Crawler Backhoe	67.10	69.68	72.43
Group B:			
Digging Mach. Operator	$ 60.39	$ 62.71	$ 65.19
Group C:			
Tractor Trailer Driver	$ 57.04	$ 59.23	$ 61.57
Groundman, Truck Driver	53.68	55.74	57.94
Equipment Mechanic	53.68	55.74	57.94
Group D:			
Flagger	$ 36.91	$ 38.32	$ 39.84

Additional 3% per hour above regular rate for entire crew when a helicopter is used. This will increase to 5% on May 03, 2027.

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:

	07/01/2026	05/03/2027	05/01/2028
Group A	$ 32.91*	$ 34.41*	$ 35.91*
Group B	$ 28.91*	$ 30.41*	$ 31.91*
Group C	$ 28.51*	$ 29.71*	$ 30.91*
Group D	$ 28.41*	$ 29.54*	$ 30.67*

*NOTE: Plus 7% of the hourly wage paid. The 7% is based on the straight time rate or the premium time rate.

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE. NOTE: Double time for all emergency work designated by the Contracting Agency.
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, 25) on HOLIDAY PAGE
Overtime	See (5, 6, 8, 15, 25) on HOLIDAY PAGE

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:

	07/01/2026	05/03/2027	05/01/2028
All terms:	$ 28.41*	$ 29.54*	$ 30.67*

*NOTE: Plus 7% of the hourly wage paid. The 7% is based on the straight time rate or the premium time rate.

6-1249a

Lineman Electrician - Teledata — 11/01/2026

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
NOTE: Applies to all public work and covered private projects, including those receiving ConnectAll funding subject to LL 224-E,solicited prior to July 1, 2025. For all projects, excluding dial-up internet access service, solicited on or after July 1, 2025, please see BROADBAND

Per hour:	07/01/2026	01/04/2027	01/03/2028	01/01/2029
Cable Splicer	$ 42.03	$ 43.30	$ 44.59	$ 45.93
Installer, Repairman	39.89	41.09	42.32	43.59
Teledata Lineman	39.89	41.09	42.32	43.59
Tech., Equip. Operator	39.89	41.09	42.32	43.59
Groundman/Flagger	21.14	21.78	22.43	23.10

For outside work, stopping at first point of attachment (demarcation).

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:

Journeyworker	$ 6.18 plus 4%*	$ 6.43 plus 5%*	$ 6.43 plus 6%*	$ 6.68 plus 7%*

*NOTE: The percentage (%) listed above is based on the hourly wage paid, straight time rate or premium time 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 — 11/01/2026

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:	07/01/2026	05/03/2027	05/01/2028
Group A:			
Lineman, Technician	$ 55.31	$ 57.40	$ 59.64
Crane, Crawler Backhoe	55.31	57.40	59.64
Certified Welder	58.08	60.27	62.62
Group B:			
Digging Machine	$ 49.78	$ 51.66	$ 53.68
Group C:			
Tractor Trailer Driver	$ 47.01	$ 48.79	$ 50.69
Groundman, Truck Driver	44.25	45.92	47.71
Equipment Mechanic	44.25	45.92	47.71
Group D:			
Flagger	$ 33.19	$ 34.44	$ 35.78

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:

07/01/2026	05/03/2027	05/01/2028

Group A	$ 32.91*	$ 34.41*	$ 35.91*
Group B	$ 28.91*	$ 30.41*	$ 31.91*
Group C	$ 28.51*	$ 29.71*	$ 30.91*
Group D	$ 28.41*	$ 29.54*	$ 30.67*

*NOTE: Plus 7% of the hourly wage paid. The 7% is based on the straight time rate or the premium time rate.

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE.
NOTE: Double time for all emergency work designated by the Contracting Agency.
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, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25) on HOLIDAY PAGE
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:

	07/01/2026	05/03/2027	05/01/2028
All terms:	$ 28.41*	$ 29.54*	$ 30.67*

*NOTE: Plus 7% of the hourly wage paid. The 7% is based on the straight time rate or the premium time rate.

6-1249a-LT

Lineman Electrician - Tree Trimmer — 11/01/2026

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:	07/01/2026	01/01/2027	01/03/2027
Tree Trimmer	$ 34.67	$ 34.67	$ 36.23
Equipment Operator	30.67	30.67	32.05
Equipment Mechanic	30.67	30.67	32.05
Truck Driver	24.93	24.93	26.05
Groundman	20.53	20.53	21.45
Flagger	16.20	16.20*	16.93

* This rate may be subject to a minimum wage increase 01/01/2027.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 11.23*	$ 11.48*	$ 11.48*

*NOTE: Plus 4.5% of the hourly wage paid. The 4.5% is based on the straight time rate or the premium time 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, 16, 25) 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 11/01/2026

JOB DESCRIPTION Mason - Building **DISTRICT** 5

ENTIRE COUNTIES
Cortland, Tompkins

WAGES
Per hour: 07/01/2026
Building:
Brick/Block layer, Cement Mason $ 35.68
Plasterer/EFIS, Stone Mason, Tuck Pointer

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 32.69

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
$ 22.62	$ 27.98	$ 29.29	$ 32.11

Supplemental Benefits per hour:

1st	2nd	3rd	4th
$ 25.95	$ 27.18	$ 30.27	$ 31.86

5-3B Ith - Z2

Mason - Heavy&Highway 11/01/2026

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: 07/01/2026
Heavy & Highway:
Cement Mason $ 41.38
Bricklayer 41.38

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 27.03

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 Journeyworker's wage:

1st	2nd	3rd	4th
50%	60%	70%	80%

Supplemental benefits per hour:

1st term	$ 15.78
2nd term	$ 25.07
3rd term	$ 25.56
4th term	$ 26.05

5-3h

Mason - Tile Finisher — 11/01/2026

JOB DESCRIPTION Mason - Tile Finisher **DISTRICT** 5

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

PARTIAL COUNTIES
Allegany: Towns of Alfred, Almond, Andover and Burns in Allegany County

WAGES
Wages

Per hour:	07/01/2026
Building:	
Marble, Slate, Terrazzo and Tile Finisher	$ 35.00

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 24.47

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
$ 21.00	$ 24.50	$ 28.00

Supplemental benefits per hour:

1st	2nd	3rd
$ 15.69	$ 16.39	$ 21.13

5-3TF - Z4

Mason - Tile Setter — 11/01/2026

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:	07/01/2026

Building:	
Marble, Slate, Terrazzo and Tile Setter	$ 36.69

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 28.56

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
$ 22.01	$ 25.68	$ 29.35	$ 33.02

Supplemental benefits per hour:

1st	2nd	3rd	4th
$ 16.49	$ 17.31	$ 26.90	$ 27.73

5-3TS - Z4

Millwright — 11/01/2026

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:	07/01/2026	07/01/2027 Additional	07/01/2028 Additional
Millwright - Power Generation	$ 50.00	$ 3.00*	$ 3.00*

* 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 weld.
- 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	$ 28.45*

*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	$ 11.96
Appr. 2nd year	23.50
Appr. 3rd year	25.15
Appr. 4th year	26.80

6-1163Power

Millwright — 11/01/2026

JOB DESCRIPTION Millwright **DISTRICT** 6

ENTIRE COUNTIES
Chemung, Cortland, Livingston, Monroe, Ontario, Orleans, Schuyler, Steuben, Tompkins, Wayne, Wyoming

WAGES

Per hour:	07/01/2026	07/01/2027 Additional	07/01/2028 Additional
Building	$ 40.39	$ 3.00*	$ 3.00*
Heavy & Highway	43.89		

* 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 weld.
- 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	$ 27.79

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	$ 11.96
Appr. 2nd year	23.04
Appr. 3rd year	24.62
Appr. 4th year	26.21

6-1163

Operating Engineer - Building — 11/01/2026

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, Forklift (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), Forklift (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, Forklift ("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), Revinius Widener (road widener), Single Light Plant, Steam Cleaner or Jenny.

Per hour:	07/01/2026	07/01/2027 Additional	07/01/2028 Additional	07/01/2029 Additional
Building				
Class A1**	$ 55.71	$ 4.75*	$ 4.25*	$ 4.68*
Class A	51.21	3.75*	3.75*	4.18*
Class B	49.09	3.75*	3.75*	4.18*
Class C	44.87	3.75*	3.75*	4.18*

* To be allocated at a later date.

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)

- Cranes in Luffer Configuration - A1 rate plus $ 5.00
- Cranes with external ballast (Tray or Wagon) - A1 rate plus $ 5.00
- NOTE: These premiums are in addition to the tonnage premiums if over 400 tons.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker $ 33.03

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: Hourly terms at the following percentage of Journeyworker's CLASS A wage:

1st: 60%
2nd: 65%
3rd: 70%
4th: 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:

All terms: $ 32.95

6-158-545b.s

Operating Engineer - Heavy&Highway 11/01/2026

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, Cableway, 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; 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; Jetting Plow; Maintenance Engineer; Mine Hoist; Mucking Machine or Mole; Pavement Breaker (SP Wirtgen; 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 Log 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 (if employer requires another man to clean the screen or to maintain the equipment, they shall be an Oiler); 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.
NOTE: Effective 07/01/27 Prentice Loader will move to CLASS A.

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; Forklift; 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:	07/01/2026	07/01/2027 Additional	07/01/2028 Additional	07/01/2029 Additional
CLASS A1**	$ 62.11	$ 4.29*	$ 4.42*	$ 4.56*
CLASS A	58.36	3.54*	3.67*	3.81*
CLASS B	57.48	3.54*	3.67*	3.81*
CLASS C	54.20	3.54*	3.67*	3.81*

* To be allocated at a later date.

(**) 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:

Journeyworker $ 34.45

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).

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

1st term (0-1000 hrs):	60%
2nd term (1001-2000 hrs):	70%
3rd term (2001-3000 hrs):	80%
4th term (3001-4100 hrs):	90%

An additional $ 2.50 per hour is required when an apprentice performs 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 — 11/01/2026

JOB DESCRIPTION Operating Engineer - Survey Crew **DISTRICT** 12

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, 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, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES
Dutchess: The northern portion of the county from the northern boundary line of the City of Poughkeepsie, north.

WAGES
These rates apply to Building, Tunnel, and Heavy Highway.

Per hour:
SURVEY CLASSIFICATIONS:
Party Chief - One who directs a survey party and/or works independently.
Surveyor - One who operates the surveying instruments for measurements.
Survey Assistant - One who assists the Party Chief or Surveyor.

	07/01/2026	07/01/2027 Additional	07/01/2028 Additional
Party Chief	$ 56.64	$ 5.50*	$ 5.50*
Surveyor	52.74	$ 4.50*	$ 4.50*
Surveyor Assistant	36.00	$ 3.50*	$ 3.50*

Additional $3.00/hr. for Tunnel Work.
Additional $2.50/hr. for EPA or DEC certified toxic or hazardous waste work.

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS
Per hour worked:

Party Chief	$ 32.45
Surveyor	$ 32.45
Survey Assistant	$ 20.60

OVERTIME PAY
See (B, Q) on OVERTIME PAGE

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

REGISTERED APPRENTICES
WAGES: 1000 hour terms based on percentage of Surveyor wage:

07/01/2026

0-1000	1001-2000	2001-3000
60%	70%	80%

SUPPLEMENTAL BENEFIT per hour worked:
All Terms: $ 22.65

12-158-545 D.H.H.

Operating Engineer - Survey Crew - Consulting Engineer — 11/01/2026

JOB DESCRIPTION Operating Engineer - Survey Crew - Consulting Engineer **DISTRICT** 12

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, 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, Tioga, Tompkins, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES
Dutchess: The northern portion of the county from the northern boundary line of the City of Poughkeepsie, north.

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 and/or works independently
Surveyor - One who operates the surveying instruments for measurements
Survey Assistant - One who assists the Party Chief or Surveyor.

	07/01/2026	07/01/2027 Additional	07/01/2028 Additional
Party Chief	$ 56.64	$ 5.50*	$ 5.50*
Surveyor	52.74	$ 4.50*	$ 4.50*
Survey Assistant	36.00	$ 3.50*	$ 3.50*

Additional $3.00/hr. for Tunnel Work.
Additional $2.50/hr. for EPA or DEC certified toxic or hazardous waste work.

*To be allocated at a later date.

SUPPLEMENTAL BENEFITS
Per hour worked:

Party Chief	$ 32.45
Surveyor	$ 32.45
Survey Assistant	$ 20.60

OVERTIME PAY
See (B, Q) on OVERTIME PAGE

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

REGISTERED APPRENTICES
WAGES: 1000 hour terms based on percentage of Surveyor wage:

07/01/2026

0-1000	1001-2000	2001-3000
60%	70%	80%

SUPPLEMENTAL BENEFIT per hour worked:
All Terms: $22.65

12-158-545 DCE

Operating Engineer - Tunnel 11/01/2026

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 Poughkeepsie, 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 (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); Scarifier (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:	07/01/2026	07/01/2027 Additional	07/01/2028 Additional	07/01/2029 Additional
CLASS A	$ 60.95	$ 3.54*	$ 3.67*	$ 3.81*
CLASS B	59.73	3.54*	3.67*	3.81*
CLASS C	56.94	3.54*	3.67*	3.81*
CLASS D	53.93	3.54*	3.67*	3.81*

* To be allocated at a later date.

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 Tower cranes, including self-erecting.
Crane 2: All Lattice Boom Cranes and all other 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	$ 64.95
Crane 2	63.95
Crane 3	62.95

SUPPLEMENTAL BENEFITS
Per hour:

$ 26.05
+ 10.85*

* This portion of the benefits subject to SAME PREMIUM 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 per hour: Hourly terms at the following percentage of Journeyworker's CLASS B wage.

1st term: (0-1000 hrs)	60%
2nd term: (1001-2000 hrs)	65%
3rd term: (2001-3000 hrs)	70%
4th term: (3001-4100 hrs)	75%

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.

SUPPLEMENTAL BENEFITS per hour: Same as Journeyworker.

7-158-832TL.

Painter — 11/01/2026

JOB DESCRIPTION Painter **DISTRICT** 2

ENTIRE COUNTIES
Cortland, Tompkins

WAGES
Per hour:

	07/01/2026
Painter	$ 29.12
Taper, Paperhangers, and Vinyl hangers	30.58

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 $ 1.50 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 $ 25.91

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 11/01/2026

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: 07/01/2026

Bridge	$ 47.39
Tunnel	47.39
Tank*	45.39

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:
$ 32.81

OVERTIME PAY

Exterior work only See (B, E2, E4, F, R) on OVERTIME PAGE.
All other work See (B, F, R) on OVERTIME PAGE.

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 — 11/01/2026

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

	07/01/2026
Metal Polisher	$ 41.33
Metal Polisher*	42.43
Metal Polisher**	45.33

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker:
All classifications $ 13.99

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:

	07/01/2026
1st year	$ 20.67
2nd year	22.73
3rd year	24.80
1st year*	$ 21.06
2nd year*	23.17
3rd year*	25.34
1st year**	$ 23.17
2nd year**	25.23
3rd year**	27.30

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:
Per hour:

1st year	$ 9.19
2nd year	9.19
3rd year	9.19

8-8A/28A-MP

Plumber — 11/01/2026

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: 07/01/2026

Plumber, Steamfitter, Pipefitter, Welder, HVAC, Refrigeration.	$ 52.16

SHIFT WORK
SINGLE IRREGULAR WORK SHIFT: Additional 15% premium added to the wage rate above for a single irregular work shift starting between 4:30 PM and 7:00 AM.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 28.75*

*NOTE: $ 15.27 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 through 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	$ 16.20
2nd	25.03
3rd	25.72
4th	26.34
5th	27.41

*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 11/01/2026

JOB DESCRIPTION Roofer **DISTRICT** 2

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

WAGES

Per hour:	07/01/2026	06/01/2027 Additional	06/01/2028 Additional
Roofer, Waterproofer	$ 31.79 + 1.06*	$ 3.50**	$ 4.00**

*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 6:00 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, torching, 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	$ 24.99

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:
Indentured prior to 06/01/2026:

Hours per term	
0-667 Hrs.	$ 22.25 + 0.74*
668-1334 Hrs.	23.84 + 0.79*
1335-2001 Hrs.	25.43 + 0.85*
2002-2668 Hrs.	27.02 + 0.90*
2669-3335 Hrs.	28.61 + 0.95*
3336-4000 Hrs.	30.20 + 1.01*

Indentured on or after 06/01/2026:

Hours per term	
0-600 Hrs.	$ 25.43 + 0.85*
601-1200 Hrs.	26.23 + 0.87*
1201-1800 Hrs.	27.02 + 0.90*
1801-2400 Hrs.	27.82 + 0.93*
2401-3000 Hrs.	28.61 + 0.95*
3001-3600 Hrs.	29.41 + 0.98*
3601-4200 Hrs.	30.20 + 1.01*
4201-4800 Hrs.	31.00 + 1.03*

*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, torching, 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:
Indentured prior to 06/01/2026:

Hours per term	
0-667 Hrs.	$ 20.93
668-1334 Hrs.	21.60
1335-2001 Hrs.	22.29

2002-2668 Hrs.	22.96
2669-3335 Hrs.	23.63
3336-4000 Hrs.	24.32

Indentured on or after 06/01/2026:

Hours per term	
0-600 Hrs.	$ 11.45
601-1200 Hrs.	11.45
1201-1800 Hrs.	19.50
1801-2400 Hrs.	23.30
2401-3000 Hrs.	23.63
3001-3600 Hrs.	23.97
3601-4200 Hrs.	24.32
4201-4800 Hrs.	24.65

2-203elmi

Sheetmetal Worker — 11/01/2026

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 2

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

WAGES
Per hour:

	07/01/2026	05/01/2027 Additional
Sheetmetal Worker	$ 40.82 + 1.02*	$ 4.00**

NOTE: Ten cents ($0.10) per hour additional premium to be paid when working polyresin fiberglass.
*Amount is paid for every hour worked (amount not subject to overtime premium)
**To be allocated at a later date

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker:	$ 25.33

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:
Indentured after 05/01/2025 (1-year Terms):

	1st	2nd	3rd	4th	5th
07/01/2026	$ 24.49 +0.61*	$ 26.53 +0.66*	$ 28.57 +0.71*	$ 32.66 +0.82*	$ 34.70 +0.87*

Indentured prior to 05/01/2025 (Half Year Terms):

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2026	$ 24.49 +0.61*	$ 24.49 +0.61*	$ 26.53 +0.66*	$ 28.57 +0.71*	$ 30.62 +0.77*	$ 32.66 +0.82*	$ 34.70 +0.87*	$ 36.74 +0.92*

*Amount is paid for every hour worked (amount not subject to overtime premium)

SUPPLEMENTAL BENEFITS per hour:
Indentured after 05/01/2025:

	1st	2nd	3rd	4th	5th
07/01/2026	$ 2.28	$ 21.05	$ 21.13	$ 21.30	$ 25.08

Indentured prior to 05/01/2025:

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2026	$ 2.28	$ 2.28	$ 21.05	$ 21.13	$ 21.22	$ 21.30	$ 21.38	$ 21.46

Sprinkler Fitter — 11/01/2026

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

	07/01/2026	01/01/2027	04/01/2027	01/01/2028
Sprinkler Fitter	$ 47.91	$ 47.91	$ 50.76	$ 50.76

SUPPLEMENTAL BENEFITS
Per hour

Journeyworker	$ 30.71	$ 31.71	$ 31.71	$ 32.71

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
One Half Year terms at the following wage per hour:

	07/01/2026	01/01/2027	04/01/2027	01/01/2028
1st Term	$ 24.50	$ 24.50	$ 25.73	$ 25.73
2nd Term	27.35	27.35	28.72	28.72
3rd Term	29.63	29.63	31.11	31.11
4th Term	31.91	31.91	33.50	33.50
5th Term	33.62	33.62	35.30	35.30
6th Term	36.47	36.47	38.29	38.29
7th Term	38.75	38.75	40.68	40.68
8th Term	41.03	41.03	43.08	43.08
9th Term	43.30	43.30	45.47	45.47
10th Term	45.58	45.58	47.86	47.86
Supplemental Benefits per hour:				
1st & 2nd Term	$ 10.23	$ 11.23	$ 11.23	$ 12.23
3rd & 4th Term	22.79	23.79	23.79	24.79
All Other Terms	23.04	24.04	24.04	25.04

1-669

Teamster - Building — 11/01/2026

JOB DESCRIPTION Teamster - Building **DISTRICT** 6

ENTIRE COUNTIES
Broome, Cayuga, Cortland, Delaware, Onondaga, Seneca, Tompkins, Yates

PARTIAL COUNTIES
Allegany: Only the Townships of Alfred, Almond, Burns.
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 Boylston, Redfield and Sandy Creek.
Otsego: Only the Townships of Butternuts, Laurens, Maryland, Millford, Morris, Oneonta, Otego, Unadilla, and Worchester.
Steuben: Only the Townships of Canisteo, Cohoctan, Dansville, Fremont, Greenwood, Hornell, Hartsville, Jasper, Prattsburg, Troupsburg, and West Union.
Tioga: Only the Townships of Berkshire, Candor, Newark Valley, Nichols, Owego, Richford, and Tioga. All territory east of Nichols/Smithboro to Broome County, within the 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:	07/01/2026	07/01/2027	07/01/2028
Building: (under $ 5 million*)			
GROUP A, B, C, D	$ 38.65	$ 42.31	$ 47.91
Building: (over $ 5 million*)			
GROUP A, B	$ 39.70	$ 43.36	$ 48.96
GROUP C	40.05	43.71	49.31
GROUP D	39.85	43.51	49.11

* Total project cost including General Construction, Plumbing, HVAC and Electrical

NOTE: All work performed at nuclear power plants, and fuel trucks that require a hazardous materials license, shall receive a $ 5.00 per hour premium above the applicable wage rate.

SUPPLEMENTAL BENEFITS
Per hour:

(under $ 5 million*)	$ 33.16	$ 35.51	$35.92
(over $ 5 million*)	33.96	36.31	36.73

* 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 — 11/01/2026

JOB DESCRIPTION Teamster - Heavy&Highway **DISTRICT** 6

ENTIRE COUNTIES
Cayuga, Cortland, Seneca, Tompkins, Yates

PARTIAL COUNTIES
Allegany: Only the Townships of Almond, Alfred, Burns.
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, Mechanic 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.

GROUP 3: Fuel trucks that require a HazMat license endorsement.

Per hour:	07/01/2026	07/01/2027
GROUP 1	$ 40.62	$ 44.28
GROUP 2	40.82	44.48
GROUP 3	45.62	49.28

SHIFT WORK
A single irregular work shift can start any time between 5:00 PM and 1:00 AM. All employees who work a single irregular shift on governmental mandated night work shall be paid an additional $ 5.00 per hour.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 29.94	$ 30.78

OVERTIME PAY
See (*B, B3, J, X) 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 11/01/2026

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 07/01/2026

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)	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 11/02/2026

Article 8

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	DOL	*****5784	A.J.M. TRUCKING, INC.		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	DOL		ADRIEL ISUFI		151 TYSENS LANE STATEN ISLAND NY 10306	10/27/2026	10/27/2031
DOL	DOL		AKHLAQ OULAKH		4307 28TH AVE ASTORIA NY 11103	10/11/2024	10/11/2029
DOL	DOL		ALEXANDER DELISA		411 THEODORE FREMND SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	NYC		ALL COUNTY SEWER & DRAIN, INC.		7 GREENFIELD DR WARWICK NY 10990	03/25/2022	03/25/2027
DOL	DOL	*****4904	ALMI REMODELING AND CONSTRUCTION CORP.		151 TYSENS LANE STATEN ISLAND NY 10306	10/27/2026	10/27/2031
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	*****8017	AMIN ELECTRICAL CORP.		97-23 218TH STREET QUEENS VILLAGE NY 11429	12/04/2025	12/04/2030
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 CASALE		20 HEATHER RIDGE ROAD TROY NY 12180	05/20/2025	05/20/2030
DOL	DOL		ANTHONY MONGELLI		PO BOX 2064 MONROE NY 10950	02/12/2024	02/12/2029
DOL	DOL	*****8421	B & B DRYWALL, INC		206 WARREN AVE APT 1WHITE PLAINS NY 10603	12/14/2021	12/14/2026
DOL	DOL	*****3932	B ROC CONSTRUCTION INC		7307 WOODSIDE ROAD VICTOR NY 14564	05/06/2025	05/06/2030
DOL	DA	*****2404	BJA RENOVATION, CORP		33 DOLLARD DR NORTH BABYLON NY 11703	03/19/2025	03/19/2030
DOL	DOL	*****5078	BLACK RIVER TREE REMOVAL, LLC		29807 ANDREWS ROAD BLACK RIVER NY 13032	10/17/2023	10/17/2028
DOL	DOL		C.M.C CONTRACTORS, INC.		500 WEST PUTNAM AVE SUITE 400GREENWICH CT 06830	09/03/2025	09/03/2030
DOL	DOL		CARLOS F. ESCOBAR		411 THEODORE FREMD AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	DOL		CARLOS FIGUEROA		411 THEODORE FREMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	DOL	*****4155	CASA BUILDERS, INC.	FRIEDLANDER CONSTRUCTION	64 N PUTT CONNERS ROAD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL		CESAREO TULA		120 SEARS AVE ELMSFORD NY 10523	09/26/2025	09/26/2030
DOL	DOL	*****2292	CHAMPION MAINTENANCE CONTRACTORS, INC.		211 SOUTH RIDGE STREET RYE BROOK NY 10573	09/03/2025	09/03/2030
DOL	NYC	*****2117	CHARAN ELECTRICAL ENTERPRISES		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DOL		CHARLES CASALE		551 MAIN AVENUE WYNANTSKILL NY 12198	05/20/2025	05/20/2030
DOL	DOL		CHARLES CASALE		551 MAIN AVENUE WYNANTSKILL NY 12198	05/20/2025	05/20/2030
DOL	DOL		CHRISTOPHER PEROSI		5507 NESCONSET HIGHWAY MT. SINAI NY 11766	07/17/2025	07/17/2030
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		DANIEL DELISA		211 SOUTH RIDGE STREET RYE BROOK NY 10573	09/03/2025	09/03/2030
DOL	DOL		DANIEL LOHAN		6836 N. LEXINGTON LANE NILES IL 60714	05/28/2026	05/28/2031
DOL	DOL		DANIEL ROBERT MCNALLY		7 GREENFIELD DRIVE WARWICK NY 10990	03/25/2022	03/25/2027
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	05/10/2023	05/10/2028

NYSDOL Bureau of Public Work Debarment List 11/02/2026

Article 8

DOL	DOL		DENISE NAGLE		36 OAKWOOD TRAIL S AL MONROE NY 10950	10/29/2025	10/29/2030
DOL	DOL		DINA TAYLOR		64 N PUTT CONNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL	*****2337	EGL DRAINAGE SOLUTION & REPAIRS LLC		5507 NESCONSET HIGHWAY MT. SINAI NY 11766	07/17/2025	07/17/2030
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	NYC		ENRICO MANETTA		101 MALBA DR. WHITESTONE NY 11357	04/01/2026	04/01/2031
DOL	DOL		EUGENIUSZ "GINO" KUCHAR		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DOL	*****2998	G.E.M. AMERICAN CONSTRUCTION CORP.		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	NYC		GHANSHYAM AMIN		97-23 218TH STREET QUEENS VILLAGE NY 11429	12/04/2025	12/04/2030
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		HENRY WICKE A/K/A HENRY WICKE, JR.		36 OAKWOOD TRAIL S AL MONROE NY 10950	10/29/2025	10/29/2030
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	*****6961	HUNTER ELEVATOR COMPANY, INC.		36 OAKWOOD TRAIL S AL MONROE NY 10950	10/29/2025	10/29/2030
DOL	DOL	*****2397	ISLAND BREEZE MARINE, INC.		6400 BALTIMORE NATIONAL CANTONSVILLE MD 21228	10/24/2024	10/24/2029
DOL	DOL	*****5010	J. LINDSLEY ENTERPRISE, LLC		1002 STATE ROUTE 176 FULTON NY 13069	07/30/2025	07/30/2030
DOL	DOL	*****0241	J. LINDSLEY ROOFING, LLC		211 NORTH 2ND STREET FULTON NY 13069	07/30/2025	07/30/2030
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 LINDSLEY		211 NORTH 2ND STREET	07/30/2025	07/30/2030

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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	*****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		JENNIFER LINDSLEY		211 NORTH 2ND STREET FULTON NY 13069	07/30/2025	07/30/2030
DOL	DOL		JERRY DASTON		36 OAKWOOD TRAIL S AL MONROE NY 10950	10/29/2025	10/29/2030
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 NAGLE A/K/A JOHN NAGLE, JR.		36 OAKWOOD TRAIL S AL MONROE NY 10950	10/29/2025	10/29/2030
DOL	DOL		JONATHAN DELISA		411 THEODORE FREMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	DOL		JORGE FIGUEROA		411 THEODORE FRMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	DA		JOSEPH DEMASCO		33 DOLLARD DRIVE NORTH BABYLON NY 11703	01/30/2026	01/30/2031
DOL	DA		JOSEPH DEMASCO		33 DOLLARD DRIVE NORTH BABYLON NY 11703	03/19/2025	03/19/2030
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	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		KEAN INDUSTRIES, LLC		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		KEVIN FUNEZ URBINA A/K/A KEVIN FUNEZ		1009 LYNDALE AVE TRENTON NJ 08629	12/16/2024	12/16/2029

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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		LIZETTE PONCE		411 THEODORE FREMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	NYC	*****7516	MANCO ENTERPRISES OF NY, INC.		44-17 54TH DR. MASPETH NY 11378	04/01/2026	04/01/2031
DOL	NYC	*****1783	MANETTA ENTERPISES, INC. D/B/A MANETTA INDUSTRIES		44-17 54TH DR. MASPETH NY 11378	04/01/2026	04/01/2031
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	*****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		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 BARNETT		33 DOLLARD DR BABYLON NY 11703	03/04/2025	03/04/2030
DOL	DOL		NICHOLAS RAO		411 THEODORE FREMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
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	02/09/2022	02/09/2027
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	12/18/2023	12/18/2028

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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	*****2041	QUALITY STEEL ERECTORS INC.		6836 N. LEXINGTON LANE NILES IL 60714	05/28/2026	05/28/2031
DOL	DOL	*****4772	R.W. LOBDELL CONSTRUCTION LLC		635 WEST DRYDEN ROAD FREEVILLE NY 13068	01/31/2025	01/31/2030
DOL	DOL	*****2633	RAW POWER ELECTRIC CORP.		3 PARK CIRCLE MIDDLETOWN NY 10940	07/11/2022	07/11/2027
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		ROSA GARCIA		411 THEODORE FRMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	DOL	*****7172	RZ & AL INC.		198 RIDGE AVENUE VALLEY STREAM NY 11581	06/06/2022	06/06/2027
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	NYC	*****3661	SPANIER BUILDING MAINTENANCE CORP		200 OAK DRIVE SYOSSET NY 11791	03/14/2022	03/14/2027
DOL	DOL	*****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL		STEVEN DELISA		411 THEODORE FREMND AVE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
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
DOL	DOL		SYED RAZA		198 RIDGE AVENUE NY 11581	06/06/2022	06/06/2027
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	*****4855	TECH INDUSTRIES LLC		20 HEATHER RIDGE ROAD TROY NY 12180	05/20/2025	05/20/2030
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	DOL	*****8485	TULA PLUMBING AND HEATING LLC		120 SEARS AVE ELMSFORD NY 10523	09/26/2025	09/26/2030
DOL	DOL	*****8210	UPSTATE CONCRETE & MASONRY CONTRACTING CO INC		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL		VINCENT CORRAO		PO BOX 393 NANUET NY 10954	09/17/2024	09/17/2029
DOL	DOL		WILLIAM A BELL		7307 WOODSIDE ROAD VICTOR NY 14564	05/06/2025	05/06/2030
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 SCRIVENS		4192 SIR ANDREW CIRCLE DOYELSTOWN PA 18902	07/18/2024	07/18/2029
DOL	DOL	*****9494	WND CONSTRUCTION LLC		411 THEODORE FREMD AVENUE SUITE 206RYE NY 10580	09/03/2025	09/03/2030
DOL	DOL		XENOFON EFTHIMIADIS		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028

GENERAL REQUIREMENTS

FOR

RENOVATE VETERINARY MEDICAL CENTER (VMC) LEVEL 1 FOR SURGE SPACE FOR VETERINARY RESEARCH TOWER (VRT)

CORNELL UNIVERSITY
ITHACA, NEW YORK

JUNE 25, 2026

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SECTION 01 11 00 SUMMARY OF WORK

1.0 GENERAL

1.1 DESCRIPTION

A. Work to be Done

1. This project creates swing space within the Veterinary Medical Center (VMC) to temporarily accommodate displaced labs and offices during construction of the larger Vet Research Tower (VRT) (future project). The 14,000+ square-foot Transgenic Mouse Core Facility (TMCF) located across the service yard east of the VRT, has been identified for this purpose and will be fully renovated to support temporary research laboratory and office space.

2. The work will include an almost full gut demolition and build back of open research laboratory space and smaller laboratory support spaces, as well as offices, breakrooms, and restrooms.

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. 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 CONTRACT MILESTONES

A. Project start, contractual/phase turn over dates and substantial completion dates are defined in the Instructions to Bidders and Bid Proposal Submission Form.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 11 00*****

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 (Chris Davenport) 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 effecting 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 28, 2027
- Saturday, May 29, 2027
- Sunday, May 30, 2027

b. Reunion Weekend
- Thursday, June 10, 2027
- Friday, June 11, 2027
- Saturday, June 12, 2027
- Sunday, June 13, 2027

c. Commencement Weekend
- Friday, May 26, 2028
- Saturday, May 27, 2028
- Sunday, May 28, 2028

d. Reunion Weekend
- Thursday, June 8, 2028
- Friday, June 9, 2028
- Saturday, June 10, 2028
- Sunday, June 11, 2028

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. 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 **$218,000** for 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 23 00 ALTERNATES

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. This Section describes the changes to be made under each Alternative.

B. The Specification Section containing the pertinent requirements of materials and methods to achieve the Work described herein.

1.2 DESCRIPTION OF REQUIREMENTS

A. Definition: An alternate is an amount proposed by Bidders and stated on the Bid Proposal Submission Form and in the electronic Bid Module for certain items that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the product, materials, equipment, systems or installation methods described in the Contract Documents. Alternates shall include all overhead, profit and other expenses, including bond costs, in connection therewith.

B. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted alternate is complete and fully integrated into the Project.

C. Notification: Immediately following Contract award, prepare and distribute to each party involved, notification of the status of each alternate. Indicate whether alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to alternates.

D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Include as part of each alternate, miscellaneous devices, accessory objects or similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ALTERNATE NO. 1

Provide an amount to remove existing doors, existing window, and portions of existing exterior wall assembly to provide ten (10) thermally-broken, aluminum windows. Structural work associated with the window work includes reinforcement of masonry at jambs, steel lintels at head, and masonry infill. Exterior envelope will include infill of brick masonry, thermal insulation, and air barriers. Hot water convectors and associated piping are added at window locations and modifications to the specifications of fan coils FCU-C1034 (renamed FCU-C1034-1) and FCU-C1024 (renamed FCU-C1024-1) are required. See Drawings S200, S300, A101A, A200, A310, A500, MH102A, and Technical Specifications Sections 042000, 072100, 072700, and 085113.

B. ALTERNATE NO. 2

Provide an amount to convert five (5) of the PI open workstations to private offices. Architectural scope includes partitions, doors, ceilings, and finishes to create private offices. Fire protection scope includes modifications to sprinkler and fire alarm systems to support addition of private offices. Mechanical scope includes the split of FCU-C1034 into FCU-C1034-2A serving the Open Office area and FCU-C1034-2B serving the private offices. Associated VAV unit is also spilt into two (2) units. Mechanical scope also includes modifications to ductwork distribution to support the private offices. Electrical scope includes power, lighting, and telecom fixtures changes to support private offices. See Drawings A101B, F100, FA-102, MH102B, E102, E122, and TC102.

*****END OF SECTION 01 23 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 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 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. Removal and disposal of asbestos containing material shall be performed by the Contractor in accordance with Division 2 specifications.

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 MERCURY COLLECTION

A. Building may contain mercury. Mercury is a metal that is liquid at room temperature and is toxic to humans and the environment. Mercury can accumulate under laboratory benches and especially in the pipes in old laboratories. Dismantling old fixtures with care can prevent unnecessary spills. The Contractor shall protect workers in accordance with OSHA regulations. Mercury is regulated by OSHA and the EPA. If encountered, mercury shall be collected safely utilizing proper measures to prevent exposure and must be turned over to Cornell Environment, Health and Safety for disposal. **In the event of a spill, leave and secure the area, call Cornell Dispatch 255-1111 and request the campus Spill Response Team.**

1.7 ANIMAL USE FACILITIES-HAZARD COMMUNICATION

A. Certain facilities at Cornell may be used for research, testing or teaching with animals. Some individuals may be at greater risk for health symptoms and effects from direct or indirect exposure to animals. Individuals with medical conditions such as immunocompromised health status, allergies, pregnancy or anticipated pregnancy may be at greater risk. It is the responsibility of the Contractor to inform their employees of associated potential risks and take appropriate action with respect to their health and safety. Questions regarding the presence of animals in a specific facility may be directed to the Owner's Representative or Facility Manager.

1.8 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.

1.9 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*****

ATLANTIC TESTING LABORATORIES

WBE certified company

Binghamton
126 Park Avenue
Suite 1A
Binghamton, NY 13903
607-773-1812 (T)
atlantictesting.com

May 2, 2024

Stantec Architecture
61 Commercial Street, Suite 100
Rochester, New York 14614

Attn: Andrew Petrosky, AIA, NCARB
Architectural Leader/Principal

Re: Limited Asbestos Survey
Transgenic Mouse Care Facility (TMCF) Swing Space
Cornell University Veterinary Research Tower (VRT) Building Renovation
Ithaca, New York
ATL Report No. ET5336AI-01-05-24

Enclosed is a copy of the Limited Asbestos Survey report prepared for the referenced site. This project was completed in accordance with the scope of work outlined in our contract (ATL No. ET5998-278-278-23), dated May 4, 2023, and via Stantec Subconsultant Agreement, dated October 12, 2023.

Please contact our office should you have any questions, or if we may be of further assistance.

Sincerely,
ATLANTIC TESTING LABORATORIES, Limited

Jordan L. Stachowiak
Project Scientist

JLS/JDG/js

Enclosures

LIMITED ASBESTOS SURVEY

TRANSGENIC MOUSE CARE FACILITY (TMCF) SWING SPACE
CORNELL UNIVERSITY VETERINARY RESEARCH TOWER (VRT) BUILDING RENOVATION
ITHACA, NEW YORK

WBE certified company

PREPARED BY:

Atlantic Testing Laboratories, Limited
126 Park Avenue, Suite 1B
Binghamton, New York 13903

PREPARED FOR:

Stantec Architecture
61 Commercial Street, Suite 100
Rochester, New York 14614

ATL REPORT NO. ET5336CE-01-05-24

May 2, 2024

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1.0 INTRODUCTION

1.1 Purpose

Atlantic Testing Laboratories, Limited (ATL) was retained by Stantec Architecture, to perform a limited asbestos survey of designated areas within the Transgenic Mouse Care Facility (TMCF) Swing Space. The limited survey was performed on April 1 through 5, April 15 and 18, 2024. The purpose of the limited asbestos survey was to identify asbestos-containing materials (ACM) that are present on exposed surfaces within the subject areas and may have a significant impact on planned building renovation activities. The limited asbestos survey procedures and report format that follow are in general compliance with applicable local, state, and federal rules and regulations.

1.2 Project Team and Certifications

Members of the ATL project team included Jordan L. Stachowiak, Project Scientist and Dylan M. Putnam, Senior Environmental Services Technician. Certifications of ATL's field survey team members and a copy of applicable company licenses maintained by ATL are included in Appendix A.

2.0 SCOPE OF WORK

2.1 Project Description

The project site is located at 602 Tower Road, Ithaca, Tompkins County, New York.

The intent of the limited asbestos survey was to identify suspect ACM that are located within designated areas of the subject site as shown on the existing Swing Space Floor Layout Drawing and may be impacted during a proposed Veterinary Research Tower (VRT) building renovation project.

The limited asbestos survey was conducted for the subject areas, as directed by Andrew Petrosky, representing Stantec Architecture. The subject areas were occupied and operational at the time of the sampling event.

2.2 Inaccessible Areas

The extent of inaccessible areas is dependent upon the building type, construction materials, history of renovations and repairs, and project scope. Concealed materials may exist in areas that are not readily exposed to view. Although this limited asbestos survey was performed to identify ACM within the subject areas, potential ACM may have escaped detection that could be encountered during future building demolition and/or renovation activities. Wall, ceiling, floor, roofing, and/or other component systems may contain concealed suspect ACM. If any suspect ACM are encountered during demolition and/or renovation activities, the activities disturbing the suspect ACM must stop and the material must be sampled, and laboratory analyzed in accordance with applicable regulations.

2.3 Document Review

Documents that were provided to ATL for review during the limited asbestos or hazardous materials survey included.

- Delta Engineers, Architecture, & Land Surveyors, Vet Medical Center Building 1164-Suspect Asbestos Material Overview, dated January 19, 2015.
- Stantec, Cornell University VRT Renovations, existing first floor swing space Drawing.
- Stantec, Cornell-Veterinary Medical Center-Swing Space Concept Drawing, dated January 26, 2024.

2.4 Limitations

This report has been prepared in accordance with the scope of work outlined in ATL's contract (ATL No. ET5998-278-278-23), dated May 4, 2023, and via Stantec Subconsultant Agreement, dated October 12, 2023, and should not be used as abatement specifications or design documents. The findings, conclusions, and recommendations presented in this report are based on the field observations made by representatives of ATL and the information provided by representatives of Stantec Architecture.

Quantities and locations of sampled materials are approximate, and should be verified by the abatement contractor(s) prior to providing actual cost quotations and/or initiating abatement activities. Variations in reported quantities and locations for sampled materials, in addition to the discovery of suspect materials not identified in this report, is possible due to the presence of inaccessible areas, as described in Section 2.2 of this report.

The findings and opinions are relevant to the dates of our site work and should not be relied on to represent conditions at substantially later dates.

3.0 ASBESTOS

3.1 Methodology

A visual examination of the designated areas of the subject building was conducted by an Asbestos Building Inspector to identify suspect ACM. Functional spaces were identified to assist while locating suspect ACM. A functional space is defined as a spatially distinct area within a building that contains identifiable populations of building occupants. A functional space may include a room, a group of rooms, or other defined area, and several functional spaces may comprise a single homogeneous sampling area. A homogeneous sampling area is defined as an area that is uniform by color, texture, construction/application, and general appearance. Each identified functional space was visually examined to determine the locations of suspect ACM. These materials were then delineated into homogeneous sampling areas.

Samples of each accessible homogeneous area were collected and placed in clean, labeled containers. The appropriate custody documentation was completed and the suspect ACM samples were submitted to AmeriSci New York (AmeriSci), located in New York, New York. The samples were laboratory analyzed by polarized light microscopy (PLM) and transmission electron microscopy (TEM) methodologies, as applicable. AmeriSci is a New York State Department of Health (NYSDOH) certified laboratory for PLM and TEM analysis under Environmental Laboratory Approval Program (ELAP) No. 11480. AmeriSci is also accredited by the National Institute of Standards and Technology (NIST), under the National Voluntary Laboratory Accreditation Program (NVLAP).

3.2 Regulatory Compliance

In New York State, there are multiple regulatory agencies that have jurisdiction over ACM in buildings. Asbestos survey requirements are primarily regulated or specified by the New York State Department of Labor (NYSDOL), the New York State Department of Health (NYSDOH), the Occupational Safety and Health Administration (OSHA), and the United States Environmental Protection Agency (EPA).

The NYSDOL established Part 56 of The Official Compilation of Codes, Rules, and Regulations (cited as 12 NYCRR, Part 56) to address the proper identification, handling, removal, and disposal of ACM in buildings. Asbestos survey requirements are specified in Subpart 56-5.1 "Asbestos Survey Requirements for Building/Structure Demolition, Renovation, Remodeling and Repair." The NYSDOL also works in conjunction with the NYSDOH to establish and maintain asbestos safety training program requirements, and enforce personnel certifications and licensing protocol for asbestos contractors.

The OSHA defines requirements for asbestos surveys and identification of ACM and presumed asbestos-containing materials (PACM) in 29 CFR 1926.1101 (k) "Communication of Hazards." Under this regulation, OSHA makes reference to conducting inspections according to 1926.1101 (k)(5)(ii)(B) and 1926.1101 (k)(5)(iii) or pursuant to the requirements of the Asbestos Hazard Emergency Response Act (AHERA) 40 CFR Part 763, Subpart E "Asbestos-Containing Materials in Schools." The AHERA is regulated by the EPA, and applies to primary and secondary schools only; however, the procedures mandated under AHERA are generally considered the industry standards for surveys, as these are typically the most stringent.

3.3 Summary of Findings

A total of 115 homogeneous areas of suspect ACM were identified during the visual examination, from which 270 bulk samples were collected and subsequently submitted to a NYSDOH approved laboratory for analysis. Approximate sample locations are depicted on the Sample Location Plans, contained in Appendix B. A copy of laboratory reports and sample custody documentation are contained in Appendix C. Table D-I contained in Appendix D, provides a summary of the identified suspect ACM and associated analytical results.

The EPA, NYSDOL, and other regulatory agencies define ACM as any material containing greater than 1% of asbestos. None of the materials sampled were determined to be ACM.

Other materials that were observed, but are not considered suspect ACM, include the following;

• Glass	• Nylon-Coated Wire Jacket
• Wood	• Metal
• Ceramic Tile	• Doors

4.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are prepared from ATL's understanding that the subject areas may be subject to renovation projects. Should the management of the building areas change, it is recommended that the findings be revisited to reflect appropriate operations and management practices for hazardous materials containing items.

4.1 General

1. Concealed regulated hazardous materials may exist at the site that could be encountered during future building renovation activities. Wall, ceiling, floor, roofing, and/or other component systems may contain concealed suspect hazardous materials. If any suspect asbestos-containing materials items are encountered during renovation activities, the activities disturbing the suspect material must stop and the material must be sampled and laboratory analyzed or otherwise managed pursuant to in accordance with applicable regulations.

4.2 Asbestos-Containing Materials

1. None of the materials sampled were determined to be ACM.

2. Subpart 56-5(g) of 12 NYCRR Part 56 specifies requirements for transmittal of asbestos survey information by the owner or owner's agent. One copy of the asbestos survey report shall be sent to the local government entity charged with issuing a permit for such demolition, renovation, remodeling, or repair work under applicable State or local laws. If controlled demolition or pre-demolition activities will be performed, one copy of the asbestos survey report shall be submitted to the appropriate Asbestos Control Bureau district office. One copy of the asbestos survey report must be kept on the construction site throughout the duration of the asbestos project and any associated demolition, renovation, remodeling, or repair project.

APPENDIX A

LICENSES AND CERTIFICATIONS

Asbestos Certificate Code Classifications

The following letter codes shown on the enclosed asbestos certificates represent the corresponding asbestos classifications:

A - Asbestos Handler
B - Allied Trades
C - Air Sampling Technician
D - Building Inspector
E - Management Planner
F - Operations & Maintenance
G - Asbestos Supervisor
H - Asbestos Project Monitor
I - Asbestos Project Designer

WE ARE YOUR DOL

NEW YORK STATE | Department of Labor

DIVISION OF SAFETY & HEALTH LICENSE AND CERTIFICATE UNIT, STATE OFFICE CAMPUS, BLDG. 12, ALBANY, NY 12226

ASBESTOS HANDLING LICENSE

Atlantic Testing Laboratories, Limited
P.O. Box 29, Canton, NY, 13617

License Number: 29276
License Class: RESTRICTED
Date of Issue: 10/02/2023
Expiration Date: 11/30/2024
Duly Authorized Representative: Marijean B Remington

This license has been issued in accordance with applicable provisions of Article 30 of the Labor Law of New York State and of the New York State Codes, Rules and Regulations (12 NYCRR Part 56). It is subject to suspension or revocation for a (1) serious violation of state, federal or local laws with regard to the conduct of an asbestos project, or (2) demonstrated lack of responsibility in the conduct of any job involving asbestos or asbestos material.

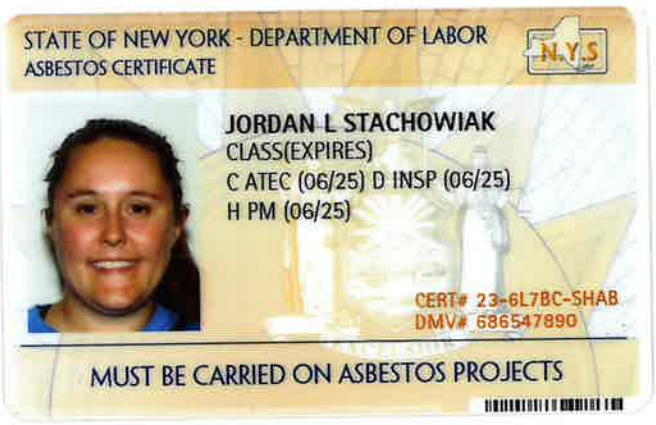
This license is valid only for the contractor named above and this license or a photocopy must be prominently displayed at the asbestos project worksite. This license verifies that all persons employed by the licensee on an asbestos project in New York State have been issued an Asbestos Certificate, appropriate for the type of work they perform, by the New York State Department of Labor.

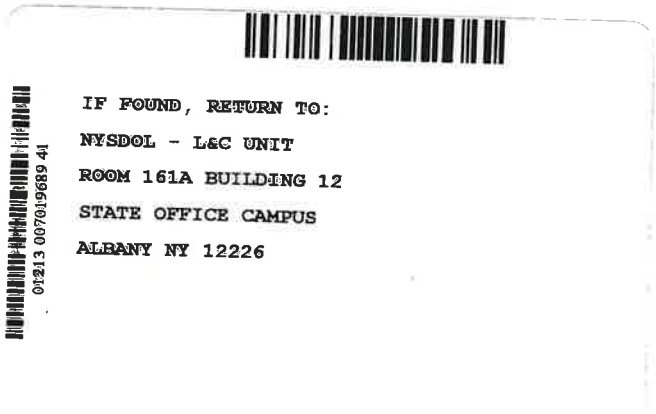
Amy Phillips, Director
For the Commissioner of Labor

ATLANTIC TESTING LABORATORIES

WBE certified company

Syracuse
6085 Court Street Road
Syracuse, NY 13206
315-699-5281 (T)
atlantictesting.com





ATLANTIC TESTING LABORATORIES

WBE certified company

Syracuse
6085 Court Street Road
Syracuse, NY 13206
315-699-5281 (T)
atlantictesting.com

New York State Department of Health Certificate of Asbestos Safety Training

This form is the official record of successful completion of a New York State accredited asbestos safety training course.

Certificate No. 943281

I –To be completed by Trainee

Name of Trainee (print)	NYS Depart. of Motor Vehicles ID (DMV ID)[1]	
Jordan Stachowiak	6866 547 890	
Signature of Trainee: Jordan Stachowiak	Telephone Number: 315-427-2845	Date of Birth[1]: 6/11/1993
Address: 301 Mansfield Drive (Street or PO Box)	Camillus (City)	New York (State) 13031 (Zip Code)

II—To be completed by Training Sponsor

Provider's Name	Telephone Number
Atlantic Testing Laboratories, Limited	315-386-4578
Address: 6391 U.S. Highway 11, Canton, New York	Course Location: ATL Syracuse Office, 6085 Court Street Road, Syracuse, New York 13206
Zip Code 13617	

Course Title: Inspector ☐ Initial ☒ Refresher | *NYS DOH use only* ☐ DOH Equivalency [2]

Training Language: ☒ English ☐ Other: _____ Exam Grade/Date: 96

Dates of Training: From: 11/15/23 To: 11/15/23 Expires: 11/15/24

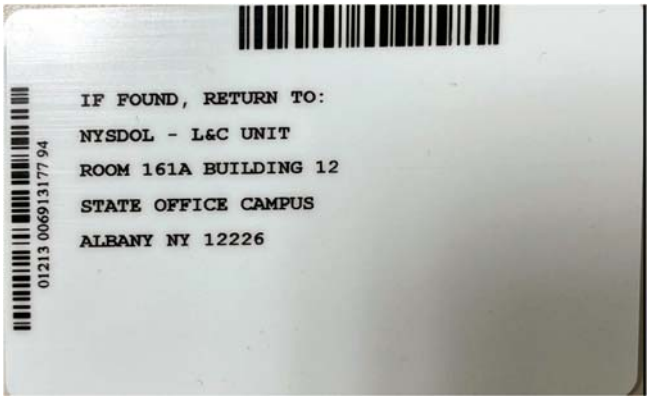
I certify that the asbestos safety training course given on the above date complied with both 10 NYCRR Part 73 and TSCA Title II, was consistent with the curriculum and instructors approved by the New York State Department of Health, and the trainee receiving this certificate completed the training course and successfully passed the examination.

Training Director[2]: Joseph D. Gracewski (Print) _____ (Signature)

DOH-2832 (10/03) [1] Optional Information [2] DOH Equivalency signed by NYS DOH representative only

DEPT. OF LABOR


STATE OF NEW YORK - DEPARTMENT OF LABOR
ASBESTOS CERTIFICATE
N.Y.S
DYLAN PUTNAM
CLASS(EXPIRES)
C ATEC (07/24) D INSP (07/24)
H PM (07/24)
CERT# 23-6TL7Y-SHAB
DMV# 572488805
MUST BE CARRIED ON ASBESTOS PROJECTS


IF FOUND, RETURN TO:
NYSDOL - L&C UNIT
ROOM 161A BUILDING 12
STATE OFFICE CAMPUS
ALBANY NY 12226
01213 006913177 94

New York State Department of Health Certificate of Asbestos Safety Training

This form is the official record of successful completion of a New York State accredited asbestos safety training course.

Certificate No. 926909

I –To be completed by Trainee

Name of Trainee (print)	NYS Depart. of Motor Vehicles ID (DMV ID)[1]	
Dylan Putnam	512 488 805	
Signature of Trainee	Telephone Number	Date of Birth[1]
Webinar		7/14/98
Address		
1309 Rowley Jerome Rd (Street or PO Box)	fabius (City)	NY (State) 13063 (Zip Code)

II—To be completed by Training Sponsor

Provider's Name	Telephone Number
EAST Centers of NY	585-435-1881
Address: 1555 Lyell Ave, Suite 122, Rochester, NY 14606	Course Location: Webinar
Zip Code	

Course Title: Inspector ☐ Initial ☒ Refresher | *NYS DOH use only* ☐ DOH Equivalency [2]

Training Language: ☒ English ☐ Other: _____ Exam Grade/Date: 100/5-12-23

Dates of Training: From: 5/12/23 To: 5/12/23 Expires: 5/12/24

I certify that the asbestos safety training course given on the above date complied with both 10 NYCRR Part 73 and TSCA Title II, was consistent with the curriculum and instructors approved by the New York State Department of Health, and the trainee receiving this certificate completed the training course and successfully passed the examination.

Training Director[2]: Kevin Hutton (Print) _____ (Signature)

DOH-2832 (10/03) [1] Optional Information [2] DOH Equivalency signed by NYS DOH representative only

STUDENT

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2025
Issued April 01, 2024

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MS. KAROL H. LU
AMERICA SCIENCE TEAM NEW YORK, INC
117 EAST 30TH ST
NEW YORK, NY 10016

NY Lab Id No: 11480

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Miscellaneous

Asbestos in Friable Material	Item 198.1 of Manual
	EPA 600/M4/82/020
Asbestos in Non-Friable Material-PLM	Item 198.6 of Manual (NOB by PLM)
Asbestos in Non-Friable Material-TEM	Item 198.4 of Manual

Serial No.: 68795

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/, by phone (518) 485-5570 or by email to elap@health.ny.gov.

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200546-0

AmeriSci New York

New York, NY

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

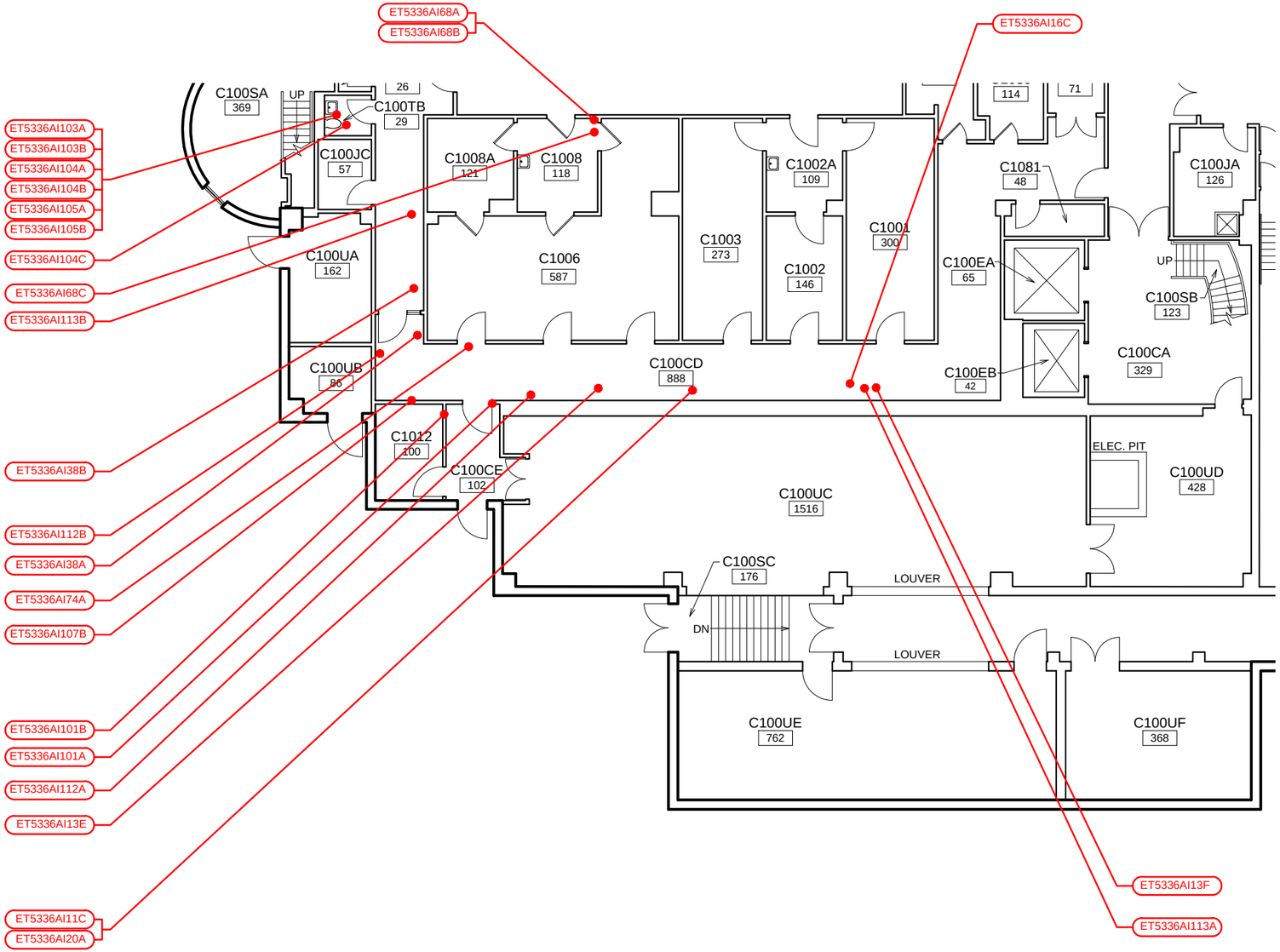
2023-07-01 through 2024-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

APPENDIX B

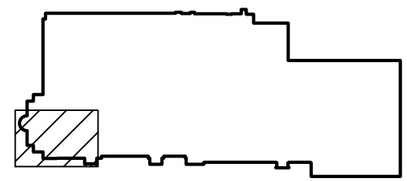
SAMPLE LOCATION PLANS



Partial First Floor Sample Location Plan
Scale: NTS

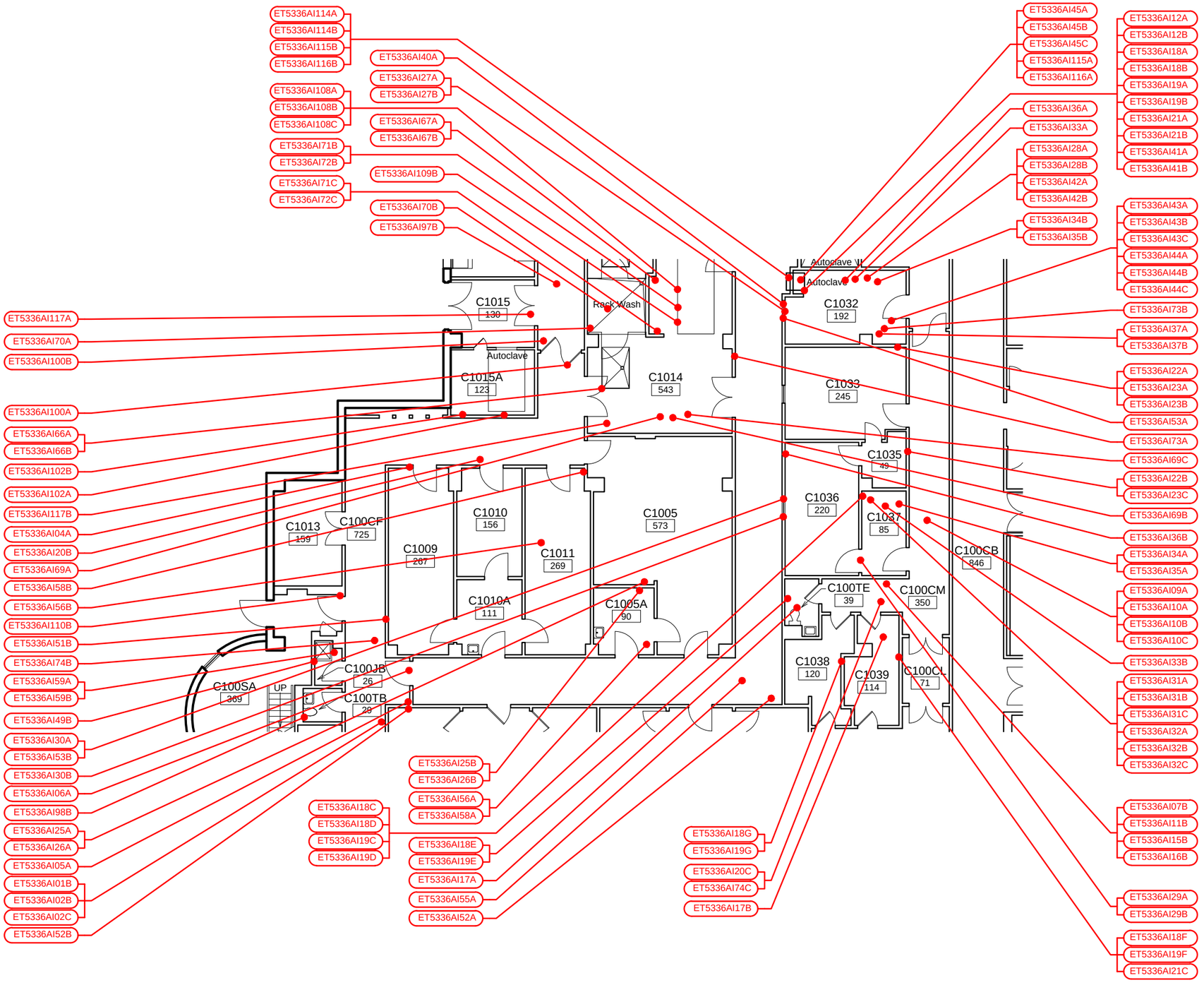
LEGEND :

ET5336AI01A — Suspect Asbestos Sample ID and Approximate Location



Key Plan
Scale: NTS

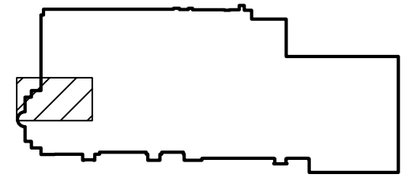
SAMPLE LOCATION PLAN	Drawn By: JDF	Drawing: 1 of 3	Scale: As Noted	Project No.: ET5336	Date : May 2024
Cornell University Veterinary Reserch Tower Building Renovation Transgenic Mouse Core Facility Swing Space Ithaca, New York	ATLANTIC TESTING LABORATORIES, Limited Albany, NY · Binghamton, NY · Buffalo, NY · Canton, NY · Elmira, NY · Plattsburgh, NY Poughkeepsie, NY · Rochester, NY · Syracuse, NY · Utica, NY · Watertown, NY WBE certified company www.AtlanticTesting.com				



Partial First Floor Sample Location Plan
Scale: NTS

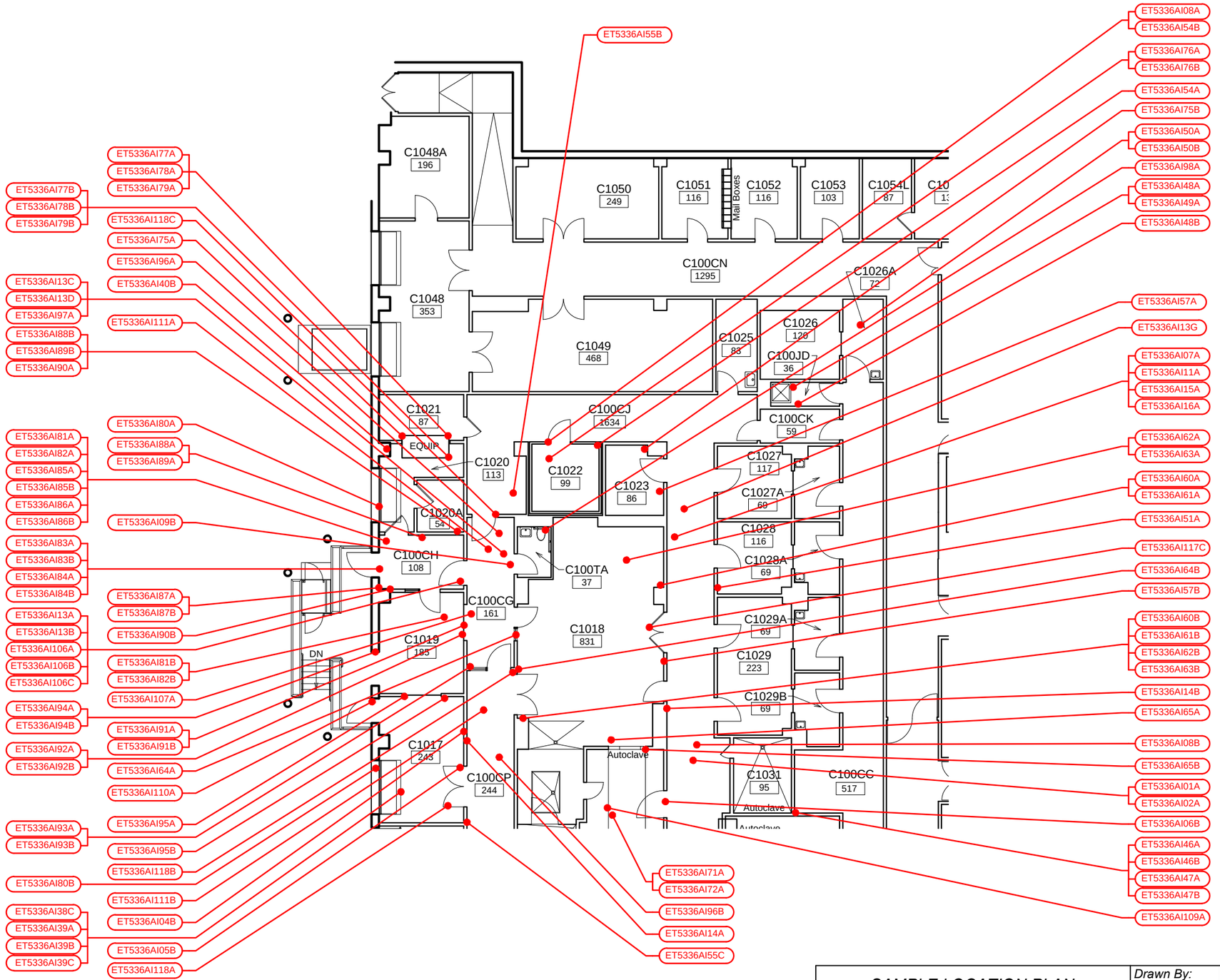
LEGEND :

ET5336AI01A — Suspect Asbestos Sample ID and Approximate Location



Key Plan
Scale: NTS

SAMPLE LOCATION PLAN	Drawn By: JDF	Drawing: 2 of 3	Scale: As Noted	Project No.: ET5336	Date : May 2024
Cornell University Veterinary Reserch Tower Building Renovation Transgenic Mouse Core Facility Swing Space Ithaca, New York	ATLANTIC TESTING LABORATORIES, Limited Albany, NY · Binghamton, NY · Buffalo, NY · Canton, NY · Elmira, NY · Plattsburgh, NY Poughkeepsie, NY · Rochester, NY · Syracuse, NY · Utica, NY · Watertown, NY WBE certified company www.AtlanticTesting.com				

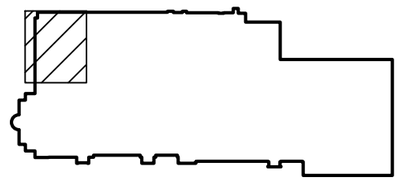


Partial First Floor Sample Location Plan

Scale: NTS

LEGEND :

ET5336AI01A — Suspect Asbestos Sample ID and Approximate Location



Key Plan

Scale: NTS

SAMPLE LOCATION PLAN	Drawn By:	Drawing:	Scale:	Project No.:	Date :
	JDF	3 of 3	As Noted	ET5336	May 2024

Cornell University
Veterinary Reserch Tower Building Renovation
Transgenic Mouse Core Facility Swing Space
Ithaca, New York

ATLANTIC TESTING LABORATORIES, Limited

Albany, NY · Binghamton, NY · Buffalo, NY · Canton, NY · Elmira, NY · Plattsburgh, NY
Poughkeepsie, NY · Rochester, NY · Syracuse, NY · Utica, NY · Watertown, NY

WBE certified company

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APPENDIX C

LABORATORY REPORTS AND CUSTODY DOCUMENTATION

AmeriSci New York
117 EAST 30TH ST.
NEW YORK, NY 10016
TEL: (212) 679-8600 • FAX: (212) 679-3114

PLM Bulk Asbestos Report

Atlantic Testing Laboratories, Limited
Attn: Andrew Amell
6431 US Highway 11

Canton, NY 13617

Date Received 04/16/24
Date Examined 04/17/24
ELAP # 11480

AmeriSci Job # 224042319
P.O. #
Page 1 **of** 46

RE: ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI01A 01	224042319-01 **Location:** C100CJ - Row 1: White Gypsum Ceiling Board	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 15%, Non-fibrous 85%			
ET5336AI01B 01	224042319-02 **Location:** C100CF - Row 1: White Gypsum Ceiling Board	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 15%, Non-fibrous 85%			
ET5336AI02A 02	224042319-03 **Location:** C100CJ - Row 2- White Joint Compound Row 1	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI02B 02	224042319-04 **Location:** C100CF - Row 2: White Joint Compound Row 1	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI02C 02	224042319-05 **Location:** C100CF - Row 2: White Joint Compound Row 1	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI04A 04	224042319-06 **Location:** C100CF - Row 4: White Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21.8%			
ET5336AI04B 04	224042319-07 **Location:** C100CP - Row 4: White Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 24.7%			
ET5336AI05A 05	224042319-08 **Location:** C100CF - Row 5: White Interface Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.1%			
ET5336AI05B 05	224042319-09 **Location:** C1017 - Row 5: White Interface Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11.4%			
ET5336AI06A 06	224042319-10 **Location:** C100CF - Row 6: Black Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6.5%			
ET5336AI06B 06	224042319-11 **Location:** C100CJ - Row 6: Black Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 12.5%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI07A 07	224042319-12 **Location:** C100CJ - Row 7: Light Gray Block Mortar	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Lt. Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI07B 07	224042319-13 **Location:** C100CM - Row 7: Light Gray Block Mortar	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Lt. Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI08A 08	224042319-14 **Location:** C100CJ - Row 8: White Penetration Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.3%			
ET5336AI08B 08	224042319-15 **Location:** C100CJ - Row 8: White Penetration Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 19.6%			
ET5336AI09A 09	224042319-16 **Location:** C100CM - Row 9: Dark Red Fire Stop Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Red, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 16.1%			
ET5336AI09B 09	224042319-17 **Location:** C100CG - Row 9: Dark Red Fire Stop Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Red, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 57.3%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI1OA 1	224042319-18 **Location:** C100CM - Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI10B 10	224042319-19 **Location:** C100CM - Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Yellow/White/Silver, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 60%, Fibrous glass 30%, Non-fibrous 10%			
ET5336AI10C 10	224042319-20 **Location:** C100CM - Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI11A 11	224042319-21 **Location:** C100CJ - Row 11: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI11B 11	224042319-22 **Location:** C100CM - Row 11: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI11C 11	224042319-23 **Location:** C100CD - Row 11: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI12A 12	224042319-24 **Location:** C1032 - Row 12: Black Interface Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13.1%			
ET5336AI12B 12	224042319-25 **Location:** C1032 - Row 12: Black Interface Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 10.4%			
ET5336AI13A 13	224042319-26 **Location:** C100CH - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 30%, Fibrous glass 10%, Non-fibrous 60%			
ET5336AI13B 13	224042319-27 **Location:** C100CH - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 30%, Fibrous glass 10%, Non-fibrous 60%			
ET5336AI13C 13	224042319-28 **Location:** C100CG - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 30%, Fibrous glass 5%, Non-fibrous 65%			
ET5336AI13D 13	224042319-29 **Location:** C100CG - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 35%, Fibrous glass 5%, Non-fibrous 60%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI13E 13	224042319-30 **Location:** C100CD - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 30%, Fibrous glass 5%, Non-fibrous 65%			
ET5336AI13F 13	224042319-31 **Location:** C100CD - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 20%, Fibrous glass 10%, Non-fibrous 70%			
ET5336AI13G 13	224042319-32 **Location:** C100CJ - Row 13: White Spray-Applied Fire Proofing	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 30%, Fibrous glass 5%, Non-fibrous 65%			
ET5336AI14A 14	224042319-33 **Location:** C100CP - Row 14: White Expansion Joint Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 3.9%			
ET5336AI14B 14	224042319-34 **Location:** C100CJ - Row 14: White Expansion Joint Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 19.4%			
ET5336AI15A 15	224042319-35 **Location:** C100CJ - Row 15: Light Gray HVAC Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Lt. Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 9.4%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI15B 15	224042319-36 **Location:** C100CM - Row 15: Light Gray HVAC Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Lt. Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 8.2%			
ET5336AI16A 16	224042319-37 **Location:** C100CJ - Row 16: Silver HVAC TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 90%, Fibrous glass 5%, Non-fibrous 5%			
ET5336AI16B 16	224042319-38 **Location:** C100CM - Row 16: Silver HVAC TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 90%, Fibrous glass 5%, Non-fibrous 5%			
ET5336AI16C 16	224042319-39 **Location:** C100CD - Row 16: Silver HVAC TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 90%, Fibrous glass 5%, Non-fibrous 5%			
ET5336AI17A 17	224042319-40 **Location:** C100TE - Row 17: Off-White 2- By 4-Foot Fissured and Pinholed Ceiling Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 59.3%			
ET5336AI17B 17	224042319-41 **Location:** C1039 - Row 17: Off-White 2- By 4-Foot Fissured and Pinholed Ceiling Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 58.1%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI18A 18	224042319-42 **Location:** C1032 - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI18B 18	224042319-43 **Location:** C1032 - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI18C 18	224042319-44 **Location:** C1037 - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI18D 18	224042319-45 **Location:** C1037 - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI18E 18	224042319-46 **Location:** C100TE - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI18F 18	224042319-47 **Location:** C1039 - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI18G 18	224042319-48 **Location:** C1038 - Row 18: Off-White Skim Coat Wall Plaster	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI19A 19	224042319-49 **Location:** C1032 - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI19B 19	224042319-50 **Location:** C1032 - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI19C 19	224042319-51 **Location:** C1037 - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI19D 19	224042319-52 **Location:** C1037 - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI19E 19	224042319-53 **Location:** C100TE - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI19F 19	224042319-54 **Location:** C1039 - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI19G 19	224042319-55 **Location:** C1038 - Row 19: Light Gray Base Coat Wall Plaster Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI20A 20	224042319-56 **Location:** C100CD - Row 20: White 6-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI20B 20	224042319-57 **Location:** C100CF - Row 20: White 6-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI20C 20	224042319-58 **Location:** C100CM - Row 20: White 6-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			
ET5336AI21A 21	224042319-59 **Location:** C1032 - Row 21: Off-White Insulation Backing Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 95%, Non-fibrous 5%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI21B 21	224042319-60 **Location:** C1032 - Row 21: Off-White Insulation Backing Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 95%, Non-fibrous 5%			
ET5336AI21C 21	224042319-61 **Location:** C1039 - Row 21: Off-White Insulation Backing Row 18	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 95%, Non-fibrous 5%			
ET5336AI22A 22	224042319-62 **Location:** C1032 - Row 22: White Gypsum Wall Board	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 15%, Non-fibrous 85%			
ET5336AI22B 22	224042319-63 **Location:** C100CM - Row 22: White Gypsum Wall Board	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 15%, Non-fibrous 85%			
ET5336AI23A 23	224042319-64 **Location:** C1032 - Row 23: White Joint Compound Row 22	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI23B 23	224042319-65 **Location:** C1032 - Row 23: White Joint Compound Row 22	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI23C 23	224042319-66 **Location:** C100CM - Row 23: White Joint Compound Row 22	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI25A 25	224042319-67 **Location:** C1005 - Row 25: Black 4-Inch Diameter Cove Base	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.2%			
ET5336AI25B 25	224042319-68 **Location:** C1005A - Row 25: Black 4-Inch Diameter Cove Base	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 9.6%			
ET5336AI26A 26	224042319-69 **Location:** C1005 - Row 26: Beige Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 47.9%			
ET5336AI26B 26	224042319-70 **Location:** C1005A - Row 26: Beige Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 40.8%			
ET5336AI27A 27	224042319-71 **Location:** C1032 - Row 27: Black Window Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 26.2%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI27B 27	224042319-72 **Location:** C1032 - Row 27: Black Window Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 8.2%			
ET5336AI28A 28	224042319-73 **Location:** C1032 - Row 28: Black Countertop	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI28B 28	224042319-74 **Location:** C1032 - Row 28: Black Countertop	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI29A 29	224042319-75 **Location:** C1036 - Row 29: Clear Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 17.6%			
ET5336AI29B 29	224042319-76 **Location:** C1036 - Row 29: Clear Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21%			
ET5336AI30A 30	224042319-77 **Location:** C1036 - Row 30: Clear Window Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7.2%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI30B 30	224042319-78 **Location:** C1036 - Row 30: Clear Window Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 8.8%			
ET5336AI31A 31	224042319-79 **Location:** C1037 - Row 31: White 2-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			
ET5336AI31B 31	224042319-80 **Location:** C1037 - Row 31: White 2-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			
ET5336AI31C 31	224042319-81 **Location:** C1037 - Row 31: White 2-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 5%, Non-fibrous 10%			
ET5336AI32A 32	224042319-82 **Location:** C1037 - Row 32: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.4%			
ET5336AI32B 32	224042319-83 **Location:** C1037 - Row 32: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI32C 32	224042319-84 **Location:** C1037 - Row 32: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13.7%			
ET5336AI33A 33	224042319-85 **Location:** C1032 - Row 33: Off-White Countertop Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 10.1%			
ET5336AI33B 33	224042319-86 **Location:** C1037 - Row 33: Off-White Countertop Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11.3%			
ET5336AI34A 34	224042319-87 **Location:** C1037 - Row 34: Black Sink Coating	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.7%			
ET5336AI34B 34	224042319-88 **Location:** C1032 - Row 34: Black Sink Coating	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.5%			
ET5336AI35A 35	224042319-89 **Location:** C1037 - Row 35: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7.6%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI35B 35	224042319-90 **Location:** C1032 - Row 35: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.8%			
ET5336AI36A 36	224042319-91 **Location:** C1032 - Row 36: Black Adhesive Row 28	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 26%			
ET5336AI36B 36	224042319-92 **Location:** C1036 - Row 36: Black Adhesive Row 28	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 32.7%			
ET5336AI37A 37	224042319-93 **Location:** C1032 - Row 37: Dark Gray HVAC Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11.1%			
ET5336AI37B 37	224042319-94 **Location:** C1032 - Row 37: Dark Gray HVAC Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11.7%			
ET5336AI38A 38	224042319-95 **Location:** C100CD - Row 38: White 10-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI38B 38	224042319-96 **Location:** C100CF - Row 38: White 10-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Yellow/White/Silver, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 70%, Fibrous glass 20%, Non-fibrous 10%			
ET5336AI38C 38	224042319-97 **Location:** C1017 - Row 38: White 10-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 80%, Fibrous glass 10%, Non-fibrous 10%			
ET5336AI39A 39	224042319-98 **Location:** C1017 - Row 39: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13.3%			
ET5336AI39B 39	224042319-99 **Location:** C1017 - Row 39: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 18.3%			
ET5336AI39C 39	224042319-100 **Location:** C1017 - Row 39: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 22.6%			
ET5336AI40A 40	224042319-101 **Location:** C1032 - Row 40: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 16.3%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI40B 40	224042319-102 **Location:** C1020 - Row 40: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 18%			
ET5336AI41A 41	224042319-103 **Location:** C1032 - Row 41: Gray Fire Stop Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.2%			
ET5336AI41B 41	224042319-104 **Location:** C1032 - Row 41: Gray Fire Stop Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 3.4%			
ET5336AI42A 42	224042319-105 **Location:** C1032 - Row 42: Black Caulk Row 28	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 38.8%			
ET5336AI42B 42	224042319-106 **Location:** C1032 - Row 42: Black Caulk Row 28	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 42.2%			
ET5336AI43A 43	224042319-107 **Location:** C1032 - Row 43: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI43B 43	224042319-108 **Location:** C1032 - Row 43: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			
ET5336AI43C 43	224042319-109 **Location:** C1032 - Row 43: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 90%, Fibrous glass 5%, Non-fibrous 5%			
ET5336AI44A 44	224042319-110 **Location:** C1032 - Row 44: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 18%			
ET5336AI44B 44	224042319-111 **Location:** C1032 - Row 44: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.6%			
ET5336AI44C 44	224042319-112 **Location:** C1032 - Row 44: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 20%			
ET5336AI45A 45	224042319-113 **Location:** C1032 - Row 45: Silver HVAC TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 50%, Fibrous glass 40%, Non-fibrous 10%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI45B 45	224042319-114 **Location:** C1032 - Row 45: Silver HVAC TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 40%, Fibrous glass 45%, Non-fibrous 15%			
ET5336AI45C 45	224042319-115 **Location:** C1032 - Row 45: Silver HVAC TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 50%, Fibrous glass 40%, Non-fibrous 10%			
ET5336AI46A 46	224042319-116 **Location:** C100CC - Row 46: Silver Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Silver, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 23.5%			
ET5336AI46B 46	224042319-117 **Location:** C100CC - Row 46: Silver Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Silver, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.3%			
ET5336AI47A 47	224042319-118 **Location:** C100CC - Row 47: Red Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Red, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 40.5%			
ET5336AI47B 47	224042319-119 **Location:** C100CC - Row 47: Red Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Red, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 0.1%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI48A 48	224042319-120 **Location:** C100JD - Row 48: White Fixture Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 9.9%			
ET5336AI48B 48	224042319-121 **Location:** C100JD - Row 48: White Fixture Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 5.2%			
ET5336AI49A 49	224042319-122 **Location:** C100JD - Row 49: Off-White Terrazzo	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray/White, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI49B 49	224042319-123 **Location:** C100JB - Row 49: Off-White Terrazzo	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray/White, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI50A 50	224042319-124 **Location:** C1026A - Row 50: White Sink Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.2%			
ET5336AI50B 50	224042319-125 **Location:** C1026A - Row 50: White Sink Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 17.3%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI51A 51	224042319-126 **Location:** C100CJ - Row 51: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.6%			
ET5336AI51B 51	224042319-127 **Location:** C100CF - Row 51: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21.7%			
ET5336AI52A 52	224042319-128 **Location:** C100CJ - Row 52: White Interface Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 33.6%			
ET5336AI52B 52	224042319-129 **Location:** C100CF - Row 52: White Interface Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 47.2%			
ET5336AI53A 53	224042319-130 **Location:** C100CJ - Row 53: White Window Perimeter Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 30.4%			
ET5336AI53B 53	224042319-131 **Location:** C100CJ - Row 53: White Window Perimeter Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 29%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI54A 54	224042319-132 **Location:** C100CJ - Row 54: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 40.1%			
ET5336AI54B 54	224042319-133 **Location:** C100CJ - Row 54: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 18.7%			
ET5336AI55A 55	224042319-134 **Location:** C100CJ - Row 55: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21.5%			
ET5336AI55B 55	224042319-135 **Location:** C100CJ - Row 55: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.4%			
ET5336AI55C 55	224042319-136 **Location:** C100CP - Row 55: While Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 15.1%			
ET5336AI56A 56	224042319-137 **Location:** C1005 - Row 56: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI56B 56	224042319-138 **Location:** C1011 - Row 56: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.1%			
ET5336AI57A 57	224042319-139 **Location:** CT1023 - Row 57: Black Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.9%			
ET5336AI57B 57	224042319-140 **Location:** CT1018 - Row 57: Black Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.4%			
ET5336AI58A 58	224042319-141 **Location:** C1005 - Row 58: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 16.4%			
ET5336AI58B 58	224042319-142 **Location:** C1011 - Row 58: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 12.7%			
ET5336AI59A 59	224042319-143 **Location:** C100JB - Row 59: Light Gray Cementitious Wall Patch	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI59B 59	224042319-144 **Location:** C100JB - Row 59: Light Gray Cementitious Wall Patch	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI60A 60	224042319-145 **Location:** C1018 - Row 60: White CWT Grout	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI60B 60	224042319-146 **Location:** C1018 - Row 60: White CWT Grout	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI61A 61	224042319-147 **Location:** C1018 - Row 61: CWT Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.4%			
ET5336AI61B 61	224042319-148 **Location:** C1018 - Row 61: CWT Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 12.9%			
ET5336AI62A 62	224042319-149 **Location:** C1018 - Row 62: Gray CFT Grout	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI62B 62	224042319-150 **Location:** C1018 - Row 62: Gray CFT Grout	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI63A 63	224042319-151 **Location:** C1018 - Row 63: CFT Mortar Row 62	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI63B 63	224042319-152 **Location:** C1018 - Row 63: CFT Mortar Row 62	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI64A 64	224042319-153 **Location:** C1018 - Row 64: Silver Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Silver, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 32%			
ET5336AI64B 64	224042319-154 **Location:** C1018 - Row 64: Silver Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Silver, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 28.5%			
ET5336AI65A 65	224042319-155 **Location:** C1018 - Row 65: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.8%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI65B 65	224042319-156 **Location:** C1018 - Row 65: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4%			
ET5336AI66A 66	224042319-157 **Location:** C1014 - Row 66: Brown CFT Grout	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI66B 66	224042319-158 **Location:** C1014 - Row 66: Brown CFT Grout	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI67A 67	224042319-159 **Location:** C1014 - Row 67: CFT Mortar Row 66	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI67B 67	224042319-160 **Location:** C1014 - Row 67: CFT Mortar Row 66	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI68A 68	224042319-161 **Location:** C1008 - Row 68: White 8-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 90%, Fibrous glass 5%, Non-fibrous 5%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI68B 68	224042319-162 **Location:** C1008 - Row 68: White 8-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 90%, Fibrous glass 5%, Non-fibrous 5%			
ET5336AI68C 68	224042319-163 **Location:** C1008 - Row 68: White 8-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 95%, Fibrous glass 2%, Non-fibrous 3%			
ET5336AI69A 69	224042319-164 **Location:** C1014 - Row 69: Off-White Sink Coating	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 76.4%			
ET5336AI69B 69	224042319-165 **Location:** C1014 - Row 69: Off-White Sink Coating	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 78.7%			
ET5336AI69C 69	224042319-166 **Location:** C1014 - Row 69: Off-White Sink Coating	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 79.4%			
ET5336AI70A 70	224042319-167 **Location:** C1014 - Row 70: White Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21.2%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI70B 70	224042319-168 **Location:** C1014 - Row 70: White Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 39%			
ET5336AI71A 71	224042319-169 **Location:** C1014 - Row 71: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			
ET5336AI71B 71	224042319-170 **Location:** C1014 - Row 71: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 10%, Non-fibrous 5%			
ET5336AI71C 71	224042319-171 **Location:** C1014 - Row 71: White 4-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Silver/Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 60%, Fibrous glass 30%, Non-fibrous 10%			
ET5336AI72A 72	224042319-172 **Location:** C1014 - Row 72: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 10.4%			
ET5336AI72B 72	224042319-173 **Location:** C1014 - Row 72: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13.3%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI72C 72	224042319-174 **Location:** C1014 - Row 72: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 51.8%			
ET5336AI73A 73	224042319-175 **Location:** C1014 - Row 73: Clear HVAC Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 38.1%			
ET5336AI73B 73	224042319-176 **Location:** C1014 - Row 73: Clear HVAC Seam Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.7%			
ET5336AI74A 74	224042319-177 **Location:** C100CD - Row 74: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 22.6%			
ET5336AI74B 74	224042319-178 **Location:** C100CF - Row 74: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 18%			
ET5336AI74C 74	224042319-179 **Location:** C100CM - Row 74: White Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 12%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI75A 75	224042319-180 **Location:** C1021 - Row 75: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 3.4%			
ET5336AI75B 75	224042319-181 **Location:** C1023 - Row 75: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 27%			
ET5336AI76A 76	224042319-182 **Location:** C1022 - Row 76: Gray Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11.3%			
ET5336AI76B 76	224042319-183 **Location:** C1022 - Row 76: Gray Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7.9%			
ET5336AI77A 77	224042319-184 **Location:** C1021 - Row 77: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21.4%			
ET5336AI77B 77	224042319-185 **Location:** C1020 - Row 77: White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI78A 78	224042319-186 **Location:** C1021 - Row 78: Clear Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 20%			
ET5336AI78B 78	224042319-187 **Location:** C1020 - Row 78: Clear Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Clear, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 24.3%			
ET5336AI79A 79	224042319-188 **Location:** C1021 - Row 79: Silver Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Silver, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 29.1%			
ET5336AI79B 79	224042319-189 **Location:** C1020 - Row 79: Silver Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Silver, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 10.9%			
ET5336AI80A 80	224042319-190 **Location:** C1020 - Row 80: White Window Glazing "Insufficient Material Submitted For Preparation"		NA
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			
ET5336AI80B 80	224042319-191 **Location:** C1017 - Row 80: White Window Glazing	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2%			

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PLM Bulk Asbestos Report

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI81A 81	224042319-192 **Location:** C100CH - Row 81: Gray 12- By 12-Inch Speckled Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.4%			
ET5336AI81B 81	224042319-193 **Location:** C1019 - Row 81: Gray 12- By 12-Inch Speckled Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.6%			
ET5336AI82A 82	224042319-194 **Location:** C100CH - Row 82: Black Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 12.5%			
ET5336AI82B 82	224042319-195 **Location:** C1019 - Row 82: Black Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 20.1%			
ET5336AI83A 83	224042319-196 **Location:** C100CH - Row 83: Light Blue 12- By 12-Inch Speckled Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Blue, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13.7%			
ET5336AI83B 83	224042319-197 **Location:** C100CH - Row 83: Light Blue 12- By 12-Inch Speckled Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Blue, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6.7%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI84A 84	224042319-198 **Location:** C100CH - Row 84: Yellow Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 24.3%			
ET5336AI84B 84	224042319-199 **Location:** C100CH - Row 84: Yellow Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 18.4%			
ET5336AI85A 85	224042319-200 **Location:** C100CH - Row 85: Black 12- By 12-Inch Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6%			
ET5336AI85B 85	224042319-201 **Location:** C100CH - Row 85: Black 12- By 12-Inch Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13%			
ET5336AI86A 86	224042319-202 **Location:** C100CH - Row 86: Yellow Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 13.2%			
ET5336AI86B 86	224042319-203 **Location:** C100CH - Row 86: Yellow Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 31.3%			

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI87A 87	224042319-204 **Location:** C100CH - Row 87: Light Gray Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6.1%			
ET5336AI87B 87	224042319-205 **Location:** C100CH - Row 87: Light Gray Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 8.1%			
ET5336AI88A 88	224042319-206 **Location:** C100CH - Row 88: Black 6-Inch Diameter Cove Base	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.1%			
ET5336AI88B 88	224042319-207 **Location:** C100CH - Row 88: Black 6-Inch Diameter Cove Base	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1%			
ET5336AI89A 89	224042319-208 **Location:** C100CH - Row 89: Beige Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 56.3%			
ET5336AI89B 89	224042319-209 **Location:** C100CH - Row 89: Beige Adhesive	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 41.2%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI90A 90	224042319-210 **Location:** C100CH - Row 90: Light Gray CWT Mortar	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI90B 90	224042319-211 **Location:** C100CH - Row 90: Light Gray CWT Mortar	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI91A 91	224042319-212 **Location:** C1019 - Row 91: Black Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.9%			
ET5336AI91B 91	224042319-213 **Location:** C1019 - Row 91: Black Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 9.9%			
ET5336AI92A 92	224042319-214 **Location:** C1019 - Row 92: Beige 12- By 12-Inch Speckled Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.3%			
ET5336AI92B 92	224042319-215 **Location:** C1019 - Row 92: Beige 12- By 12-Inch Speckled Floor Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4.1%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI93A 93	224042319-216 **Location:** C1019 - Row 93: Yellow Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 32.8%			
ET5336AI93B 93	224042319-217 **Location:** C1019 - Row 93: Yellow Mastic	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 41.6%			
ET5336AI94A 94	224042319-218 **Location:** C1019 - Row 94: White Window Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 29.6%			
ET5336AI94B 94	224042319-219 **Location:** C1019 - Row 94: White Window Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 32.6%			
ET5336AI95A 95	224042319-220 **Location:** C1019 - Row 95: Black Window Glazing	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 27%			
ET5336AI95B 95	224042319-221 **Location:** C1017 - Row 95: Black Window Glazing	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 27.8%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI96A 96	224042319-222 **Location:** C100CG - Row 96: Off-White 2- By 4-Foot Textured Ceiling Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 74.1%			
E15336AI96B 96	224042319-223 **Location:** C100CP - Row 96: Off-White 2- By 4-Foot Textured Ceiling Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 63.2%			
ET5336AI97A 97	224042319-224 **Location:** C100CG - Row 97: Beige 2- By 4-Foot Textured Ceiling Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 51.2%			
ET5336AI97B 97	224042319-225 **Location:** C100CP - Row 97: Beige 2- By 4-Foot Textured Ceiling Tile	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Beige, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 43.2%			
ET5336AI98A 98	224042319-226 **Location:** T100TA - Row 98: White Fixture Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.5%			
ET5336AI98B 98	224042319-227 **Location:** T100TB - Row 98: White Fixture Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.7%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI100A 100	224042319-228 **Location:** C100CP - Row 100: Black Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 12.2%			
ET5336AI100B 100	224042319-229 **Location:** C100CP - Row 100: Black Door Light Butyl	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14.5%			
ET5336AI101A 101	224042319-230 **Location:** C100CD - Row 101: White Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 50.9%			
ET5336AI101B 101	224042319-231 **Location:** C100CD - Row 101: White Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 23.7%			
ET5336AI102A 102	224042319-232 **Location:** C1015 - Row 102: Off-White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7.5%			
ET5336AI102B 102	224042319-233 **Location:** C1015 - Row 102: Off-White Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6.7%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI103A 103	224042319-234 **Location:** C100TB - Row 103: Off-White Gypsum Ceiling Board	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 20%, Non-fibrous 80%			
ET5336AI103B 103	224042319-235 **Location:** C100TB - Row 103: Off-White Gypsum Ceiling Board	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 20%, Non-fibrous 80%			
ET5336AI104A 104	224042319-236 **Location:** C100TB - Row 104: White Joint Compound Row 103	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI104B 104	224042319-237 **Location:** C100TB - Row 104: White Joint Compound Row 103	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI104C 104	224042319-238 **Location:** C100TB - Row 104: White Joint Compound Row 103	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI105A 105	224042319-239 **Location:** C100TB - Row 105: White Seam Tape Row 103	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 95%, Non-fibrous 5%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI105B 105	224042319-240 **Location:** C100TB - Row 105: White Seam Tape Row 103	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 95%, Non-fibrous 5%			
ET5336AI106A 106	224042319-241 **Location:** C100CH - Row 106: White 10-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Yellow/White/Silver, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 10%, Fibrous glass 80%, Non-fibrous 10%			
ET5336AI106B 106	224042319-242 **Location:** C100CH - Row 106: White 10-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Yellow/White/Silver, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 10%, Fibrous glass 80%, Non-fibrous 10%			
ET5336AI106C 106	224042319-243 **Location:** C100CH - Row 106: White 10-Inch Diameter Pipe TSI Jacket	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Yellow/White/Silver, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 10%, Fibrous glass 80%, Non-fibrous 10%			
ET5336AI107A 107	224042319-244 **Location:** C100CG - Row 107: Light Gray Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI107B 107	224042319-245 **Location:** C100CD - Row 107: Light Gray Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI108A 108	224042319-246 **Location:** C1014 - Row 108: Off-White Residual Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6.9%			
ET5336AI108B 108	224042319-247 **Location:** C1014 - Row 108: Off-White Residual Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 9.2%			
ET5336AI108C 108	224042319-248 **Location:** C1014 - Row 108: Off-White Residual Pipe TSI End Sealant	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 10.9%			
ET5336AI109A 109	224042319-249 **Location:** C1014 - Row 109: Gray Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 78.6%			
ET5336AI109B 109	224042319-250 **Location:** C1014 - Row 109: Gray Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 82.6%			
ET5336AI110A 110	224042319-251 **Location:** C1017 - Row 110: White Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.2%			

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PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI110B 110	224042319-252 **Location:** C100CF - Row 110: White Door Frame Caulk	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.7%			
ET5336AI111A 111	224042319-253 **Location:** C100CP - Row 111: Beige Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Beige/Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI111B 111	224042319-254 **Location:** C100CG - Row 111: Beige Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Beige/Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI112A 112	224042319-255 **Location:** C100CD - Row 112: Dark Gray Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Dark Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI112B 112	224042319-256 **Location:** C100CF - Row 112: Dark Gray Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Dark Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI113A 113	224042319-257 **Location:** C100CD - Row 113: Dark Gray Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Dark Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI113B 113	224042319-258 **Location:** C100CD - Row 113: Dark Gray Flooring Material	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Dark Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
ET5336AI114A 114	224042319-259 **Location:** C1032 - Row 114: Black Residual Flooring Material	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 16.4%			
ET5336AI114B 114	224042319-260 **Location:** C1032 - Row 114: Black Residual Flooring Material	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21.9%			
ET5336AI115A 115	224042319-261 **Location:** C1032 - Row 115: White Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 35%			
ET5336AI115B 115	224042319-262 **Location:** C1032 - Row 115: White Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 25.8%			
ET5336AI116A 116	224042319-263 **Location:** C1032 - Row 116: Gray Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 16.2%			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI116B 116	224042319-264 **Location:** C1032 - Row 116: Gray Gasket	***No***	NAD (by NYS ELAP 198.6) by Bo Sun on 04/17/24
Analyst Description: Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 17.7%			
ET5336AI117A 117	224042319-265 **Location:** C1015 - Row 117: Brown Fire Door Insulation	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 100%, Non-fibrous Trace			
ET5336AI117B 117	224042319-266 **Location:** C1014 - Row 117: Brown Fire Door Insulation	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 100%, Non-fibrous Trace			
ET5336AI117C 117	224042319-267 **Location:** C1018 - Row 117: Brown Fire Door Insulation	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 100%, Non-fibrous Trace			
ET5336AI118A 118	224042319-268 **Location:** C1017 - Row 118: Off-White Fire Door Insulation	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 100%, Non-fibrous Trace			
ET5336AI118B 118	224042319-269 **Location:** C100CG - Row 118: Off-White Fire Door Insulation	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24
Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 100%, Non-fibrous Trace			

See Reporting notes on last page

PLM Bulk Asbestos Report

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space;
Ithaca, New York

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI118C 118	224042319-270 **Location:** C10OCJ - Row 118: Off-White Fire Door Insulation	***No***	NAD (by NYS ELAP 198.1) by Bo Sun on 04/17/24

Analyst Description: Off-White, Homogeneous, Fibrous, Bulk Material
Asbestos Types:
Other Material: Fibrous glass 100%, Non-fibrous Trace

Reporting Notes:

Analyzed by: Bo Sun
Date: 4/17/2024

Reviewed by: Karol H. Lu

*NAD/NSD =no asbestos detected; NA =not analyzed; NA/PS=not analyzed/positive stop, (SOF-V) = Sprayed On Fireproofing containing Vermiculite; (SM-V) = Surfacing Material containing Vermiculite; PLM Bulk Asbestos Analysis using Motic, Model BA310 Pol Scope, Microscope, Serial #: 1190000538, by Appd E to Subpt E, 40 CFR 763 quantified by either CVES or 400 pt ct as noted for each analysis (NVLAP 200546-0), ELAP PLM Method 198.1 for NY friable samples, which includes the identification and quantitation of vermiculite, or ELAP 198.6 for NOB samples, or EPA 400 pt ct by EPA 600-M4-82-020 (NY ELAP Lab 11480); Note:PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non asbestos-containing in NY State (also see EPA Advisory for floor tile, FR 59,146,38970,8/1/94) National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab.This PLM report relates ONLY to the items tested. RI Cert AAL-094, CT Cert PH-0186, Mass Cert AA000054, NJ Lab ID #NY031.

_____END OF REPORT_____

Client Name: Atlantic Testing Laboratories, Limited

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
01	ET5336AI01A	01	----	----	----	----	NAD	NA
Location: C100CJ - Row 1: White Gypsum Ceiling Board								
02	ET5336AI01B	01	----	----	----	----	NAD	NA
Location: C100CF - Row 1: White Gypsum Ceiling Board								
03	ET5336AI02A	02	----	----	----	----	NAD	NA
Location: C100CJ - Row 2- White Joint Compound Row 1								
04	ET5336AI02B	02	----	----	----	----	NAD	NA
Location: C100CF - Row 2: White Joint Compound Row 1								
05	ET5336AI02C	02	----	----	----	----	NAD	NA
Location: C100CF - Row 2: White Joint Compound Row 1								
06	ET5336AI04A	04	0.278	34.2	44.0	21.8	NAD	NAD
Location: C100CF - Row 4: White Door Frame Caulk								
07	ET5336AI04B	04	0.241	32.1	43.1	24.7	NAD	NAD
Location: C100CP - Row 4: White Door Frame Caulk								
08	ET5336AI05A	05	0.247	34.2	63.7	2.1	NAD	NAD
Location: C100CF - Row 5: White Interface Caulk								
09	ET5336AI05B	05	0.107	22.7	65.9	11.4	NAD	NAD
Location: C1017 - Row 5: White Interface Caulk								
10	ET5336AI06A	06	0.233	40.2	53.3	6.5	NAD	NAD
Location: C100CF - Row 6: Black Door Light Butyl								
11	ET5336AI06B	06	0.133	66.7	20.8	12.5	NAD	NAD
Location: C100CJ - Row 6: Black Door Light Butyl								
12	ET5336AI07A	07	----	----	----	----	NAD	NA
Location: C100CJ - Row 7: Light Gray Block Mortar								
13	ET5336AI07B	07	----	----	----	----	NAD	NA
Location: C100CM - Row 7: Light Gray Block Mortar								
14	ET5336AI08A	08	0.186	42.6	43.1	14.3	NAD	NAD
Location: C100CJ - Row 8: White Penetration Caulk								
15	ET5336AI08B	08	0.147	42.3	38.1	19.6	NAD	NAD
Location: C100CJ - Row 8: White Penetration Caulk								
16	ET5336AI09A	09	0.212	51.1	32.8	16.1	NAD	NAD
Location: C100CM - Row 9: Dark Red Fire Stop Sealant								

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Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
17	ET5336AI09B	09	0.266	51.4	-8.7	57.3	NAD	NAD
Location: C100CG - Row 9: Dark Red Fire Stop Sealant								
18	ET5336AI1OA	1	----	----	----	----	NAD	NA
Location: C100CM - Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket								
19	ET5336AI10B	10	----	----	----	----	NAD	NA
Location: C100CM - Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket								
20	ET5336AI10C	10	----	----	----	----	NAD	NA
Location: C100CM - Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket								
21	ET5336AI11A	11	----	----	----	----	NAD	NA
Location: C100CJ - Row 11: White 4-Inch Diameter Pipe TSI Jacket								
22	ET5336AI11B	11	----	----	----	----	NAD	NA
Location: C100CM - Row 11: White 4-Inch Diameter Pipe TSI Jacket								
23	ET5336AI11C	11	----	----	----	----	NAD	NA
Location: C100CD - Row 11: White 4-Inch Diameter Pipe TSI Jacket								
24	ET5336AI12A	12	0.204	50.2	36.6	13.1	NAD	NAD
Location: C1032 - Row 12: Black Interface Caulk								
25	ET5336AI12B	12	0.214	53.3	36.2	10.4	NAD	NAD
Location: C1032 - Row 12: Black Interface Caulk								
26	ET5336AI13A	13	----	----	----	----	NAD	NA
Location: C100CH - Row 13: White Spray-Applied Fire Proofing								
27	ET5336AI13B	13	----	----	----	----	NAD	NA
Location: C100CH - Row 13: White Spray-Applied Fire Proofing								
28	ET5336AI13C	13	----	----	----	----	NAD	NA
Location: C100CG - Row 13: White Spray-Applied Fire Proofing								
29	ET5336AI13D	13	----	----	----	----	NAD	NA
Location: C100CG - Row 13: White Spray-Applied Fire Proofing								
30	ET5336AI13E	13	----	----	----	----	NAD	NA
Location: C100CD - Row 13: White Spray-Applied Fire Proofing								
31	ET5336AI13F	13	----	----	----	----	NAD	NA
Location: C100CD - Row 13: White Spray-Applied Fire Proofing								
32	ET5336AI13G	13	----	----	----	----	NAD	NA
Location: C100CJ - Row 13: White Spray-Applied Fire Proofing								

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Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
33	ET5336AI14A	14	0.203	36.1	59.9	3.9	NAD	NAD
Location: C100CP - Row 14: White Expansion Joint Caulk								
34	ET5336AI14B	14	0.147	35.3	45.3	19.4	NAD	NAD
Location: C100CJ - Row 14: White Expansion Joint Caulk								
35	ET5336AI15A	15	0.141	47.6	43.0	9.4	NAD	NAD
Location: C100CJ - Row 15: Light Gray HVAC Seam Sealant								
36	ET5336AI15B	15	0.147	50.9	41.0	8.2	NAD	NAD
Location: C100CM - Row 15: Light Gray HVAC Seam Sealant								
37	ET5336AI16A	16	----	----	----	----	NAD	NA
Location: C100CJ - Row 16: Silver HVAC TSI Jacket								
38	ET5336AI16B	16	----	----	----	----	NAD	NA
Location: C100CM - Row 16: Silver HVAC TSI Jacket								
39	ET5336AI16C	16	----	----	----	----	NAD	NA
Location: C100CD - Row 16: Silver HVAC TSI Jacket								
40	ET5336AI17A	17	0.156	27.6	13.0	59.3	NAD	NAD
Location: C100TE - Row 17: Off-White 2- By 4-Foot Fissured and Pinholed Ceiling Tile								
41	ET5336AI17B	17	0.172	22.1	19.7	58.1	NAD	NAD
Location: C1039 - Row 17: Off-White 2- By 4-Foot Fissured and Pinholed Ceiling Tile								
42	ET5336AI18A	18	----	----	----	----	NAD	NA
Location: C1032 - Row 18: Off-White Skim Coat Wall Plaster								
43	ET5336AI18B	18	----	----	----	----	NAD	NA
Location: C1032 - Row 18: Off-White Skim Coat Wall Plaster								
44	ET5336AI18C	18	----	----	----	----	NAD	NA
Location: C1037 - Row 18: Off-White Skim Coat Wall Plaster								
45	ET5336AI18D	18	----	----	----	----	NAD	NA
Location: C1037 - Row 18: Off-White Skim Coat Wall Plaster								
46	ET5336AI18E	18	----	----	----	----	NAD	NA
Location: C100TE - Row 18: Off-White Skim Coat Wall Plaster								
47	ET5336AI18F	18	----	----	----	----	NAD	NA
Location: C1039 - Row 18: Off-White Skim Coat Wall Plaster								
48	ET5336AI18G	18	----	----	----	----	NAD	NA
Location: C1038 - Row 18: Off-White Skim Coat Wall Plaster								

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Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
49	ET5336AI19A	19	----	----	----	----	NAD	NA
Location: C1032 - Row 19: Light Gray Base Coat Wall Plaster Row 18								
50	ET5336AI19B	19	----	----	----	----	NAD	NA
Location: C1032 - Row 19: Light Gray Base Coat Wall Plaster Row 18								
51	ET5336AI19C	19	----	----	----	----	NAD	NA
Location: C1037 - Row 19: Light Gray Base Coat Wall Plaster Row 18								
52	ET5336AI19D	19	----	----	----	----	NAD	NA
Location: C1037 - Row 19: Light Gray Base Coat Wall Plaster Row 18								
53	ET5336AI19E	19	----	----	----	----	NAD	NA
Location: C100TE - Row 19: Light Gray Base Coat Wall Plaster Row 18								
54	ET5336AI19F	19	----	----	----	----	NAD	NA
Location: C1039 - Row 19: Light Gray Base Coat Wall Plaster Row 18								
55	ET5336AI19G	19	----	----	----	----	NAD	NA
Location: C1038 - Row 19: Light Gray Base Coat Wall Plaster Row 18								
56	ET5336AI20A	20	----	----	----	----	NAD	NA
Location: C100CD - Row 20: White 6-Inch Diameter Pipe TSI Jacket								
57	ET5336AI20B	20	----	----	----	----	NAD	NA
Location: C100CF - Row 20: White 6-Inch Diameter Pipe TSI Jacket								
58	ET5336AI20C	20	----	----	----	----	NAD	NA
Location: C100CM - Row 20: White 6-Inch Diameter Pipe TSI Jacket								
59	ET5336AI21A	21	----	----	----	----	NAD	NA
Location: C1032 - Row 21: Off-White Insulation Backing Row 18								
60	ET5336AI21B	21	----	----	----	----	NAD	NA
Location: C1032 - Row 21: Off-White Insulation Backing Row 18								
61	ET5336AI21C	21	----	----	----	----	NAD	NA
Location: C1039 - Row 21: Off-White Insulation Backing Row 18								
62	ET5336AI22A	22	----	----	----	----	NAD	NA
Location: C1032 - Row 22: White Gypsum Wall Board								
63	ET5336AI22B	22	----	----	----	----	NAD	NA
Location: C100CM - Row 22: White Gypsum Wall Board								
64	ET5336AI23A	23	----	----	----	----	NAD	NA
Location: C1032 - Row 23: White Joint Compound Row 22								

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Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
65	ET5336AI23B	23	----	----	----	----	NAD	NA
Location: C1032 - Row 23: White Joint Compound Row 22								
66	ET5336AI23C	23	----	----	----	----	NAD	NA
Location: C100CM - Row 23: White Joint Compound Row 22								
67	ET5336AI25A	25	0.229	66.2	32.6	1.2	NAD	NAD
Location: C1005 - Row 25: Black 4-Inch Diameter Cove Base								
68	ET5336AI25B	25	0.236	61.1	29.3	9.6	NAD	NAD
Location: C1005A - Row 25: Black 4-Inch Diameter Cove Base								
69	ET5336AI26A	26	0.163	38.8	13.3	47.9	NAD	NAD
Location: C1005 - Row 26: Beige Adhesive								
70	ET5336AI26B	26	0.082	42.2	17.0	40.8	NAD	NAD
Location: C1005A - Row 26: Beige Adhesive								
71	ET5336AI27A	27	0.238	44.3	29.5	26.2	NAD	NAD
Location: C1032 - Row 27: Black Window Butyl								
72	ET5336AI27B	27	0.227	72.4	19.4	8.2	NAD	NAD
Location: C1032 - Row 27: Black Window Butyl								
73	ET5336AI28A	28	----	----	----	----	NAD	NA
Location: C1032 - Row 28: Black Countertop								
74	ET5336AI28B	28	----	----	----	----	NAD	NA
Location: C1032 - Row 28: Black Countertop								
75	ET5336AI29A	29	0.263	68.2	14.2	17.6	NAD	NAD
Location: C1036 - Row 29: Clear Door Light Butyl								
76	ET5336AI29B	29	0.197	64.9	14.2	21.0	NAD	NAD
Location: C1036 - Row 29: Clear Door Light Butyl								
77	ET5336AI30A	30	0.162	65.4	27.4	7.2	NAD	NAD
Location: C1036 - Row 30: Clear Window Butyl								
78	ET5336AI30B	30	0.144	66.9	24.3	8.8	NAD	NAD
Location: C1036 - Row 30: Clear Window Butyl								
79	ET5336AI31A	31	----	----	----	----	NAD	NA
Location: C1037 - Row 31: White 2-Inch Diameter Pipe TSI Jacket								
80	ET5336AI31B	31	----	----	----	----	NAD	NA
Location: C1037 - Row 31: White 2-Inch Diameter Pipe TSI Jacket								

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ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
81	ET5336AI31C	31	----	----	----	----	NAD	NA
Location: C1037 - Row 31: White 2-Inch Diameter Pipe TSI Jacket								
82	ET5336AI32A	32	0.155	48.8	36.8	14.4	NAD	NAD
Location: C1037 - Row 32: White Pipe TSI End Sealant								
83	ET5336AI32B	32	0.134	50.3	35.7	14.0	NAD	NAD
Location: C1037 - Row 32: White Pipe TSI End Sealant								
84	ET5336AI32C	32	0.100	50.6	35.7	13.7	NAD	NAD
Location: C1037 - Row 32: White Pipe TSI End Sealant								
85	ET5336AI33A	33	0.242	46.8	43.1	10.1	NAD	NAD
Location: C1032 - Row 33: Off-White Countertop Seam Sealant								
86	ET5336AI33B	33	0.217	43.8	45.0	11.3	NAD	NAD
Location: C1037 - Row 33: Off-White Countertop Seam Sealant								
87	ET5336AI34A	34	0.058	92.1	6.2	1.7	NAD	NAD
Location: C1037 - Row 34: Black Sink Coating								
88	ET5336AI34B	34	0.068	92.0	6.5	1.5	NAD	NAD
Location: C1032 - Row 34: Black Sink Coating								
89	ET5336AI35A	35	0.169	43.3	49.1	7.6	NAD	NAD
Location: C1037 - Row 35: White Caulk								
90	ET5336AI35B	35	0.153	43.6	41.6	14.8	NAD	NAD
Location: C1032 - Row 35: White Caulk								
91	ET5336AI36A	36	0.134	57.9	16.1	26.0	NAD	NAD
Location: C1032 - Row 36: Black Adhesive Row 28								
92	ET5336AI36B	36	0.132	57.6	9.7	32.7	NAD	NAD
Location: C1036 - Row 36: Black Adhesive Row 28								
93	ET5336AI37A	37	0.188	40.4	48.6	11.1	NAD	NAD
Location: C1032 - Row 37: Dark Gray HVAC Seam Sealant								
94	ET5336AI37B	37	0.248	41.2	47.1	11.7	NAD	NAD
Location: C1032 - Row 37: Dark Gray HVAC Seam Sealant								
95	ET5336AI38A	38	----	----	----	----	NAD	NA
Location: C100CD - Row 38: White 10-Inch Diameter Pipe TSI Jacket								
96	ET5336AI38B	38	----	----	----	----	NAD	NA
Location: C100CF - Row 38: White 10-Inch Diameter Pipe TSI Jacket								

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Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
97	ET5336AI38C	38	----	----	----	----	NAD	NA
Location: C1017 - Row 38: White 10-Inch Diameter Pipe TSI Jacket								
98	ET5336AI39A	39	0.197	40.2	46.5	13.3	NAD	NAD
Location: C1017 - Row 39: White Pipe TSI End Sealant								
99	ET5336AI39B	39	0.176	38.5	43.2	18.3	NAD	NAD
Location: C1017 - Row 39: White Pipe TSI End Sealant								
100	ET5336AI39C	39	0.186	34.9	42.4	22.6	NAD	NAD
Location: C1017 - Row 39: White Pipe TSI End Sealant								
101	ET5336AI40A	40	0.214	41.9	41.8	16.3	NAD	NAD
Location: C1032 - Row 40: White Caulk								
102	ET5336AI40B	40	0.202	44.0	38.0	18.0	NAD	NAD
Location: C1020 - Row 40: White Caulk								
103	ET5336AI41A	41	0.321	27.3	71.5	1.2	NAD	NAD
Location: C1032 - Row 41: Gray Fire Stop Sealant								
104	ET5336AI41B	41	0.250	26.2	70.4	3.4	NAD	NAD
Location: C1032 - Row 41: Gray Fire Stop Sealant								
105	ET5336AI42A	42	0.093	52.4	8.8	38.8	NAD	NAD
Location: C1032 - Row 42: Black Caulk Row 28								
106	ET5336AI42B	42	0.069	50.4	7.4	42.2	NAD	NAD
Location: C1032 - Row 42: Black Caulk Row 28								
107	ET5336AI43A	43	----	----	----	----	NAD	NA
Location: C1032 - Row 43: White 4-Inch Diameter Pipe TSI Jacket								
108	ET5336AI43B	43	----	----	----	----	NAD	NA
Location: C1032 - Row 43: White 4-Inch Diameter Pipe TSI Jacket								
109	ET5336AI43C	43	----	----	----	----	NAD	NA
Location: C1032 - Row 43: White 4-Inch Diameter Pipe TSI Jacket								
110	ET5336AI44A	44	0.152	39.5	42.5	18.0	NAD	NAD
Location: C1032 - Row 44: White Pipe TSI End Sealant								
111	ET5336AI44B	44	0.216	39.4	45.9	14.6	NAD	NAD
Location: C1032 - Row 44: White Pipe TSI End Sealant								
112	ET5336AI44C	44	0.156	38.8	41.2	20.0	NAD	NAD
Location: C1032 - Row 44: White Pipe TSI End Sealant								

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ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
113	ET5336AI45A	45	----	----	----	----	NAD	NA
Location: C1032 - Row 45: Silver HVAC TSI Jacket								
114	ET5336AI45B	45	----	----	----	----	NAD	NA
Location: C1032 - Row 45: Silver HVAC TSI Jacket								
115	ET5336AI45C	45	----	----	----	----	NAD	NA
Location: C1032 - Row 45: Silver HVAC TSI Jacket								
116	ET5336AI46A	46	0.154	61.0	15.5	23.5	NAD	NAD
Location: C100CC - Row 46: Silver Caulk								
117	ET5336AI46B	46	0.063	54.3	41.4	4.3	NAD	NAD
Location: C100CC - Row 46: Silver Caulk								
118	ET5336AI47A	47	0.253	44.3	15.2	40.5	NAD	NAD
Location: C100CC - Row 47: Red Gasket								
119	ET5336AI47B	47	0.210	46.6	53.3	0.1	NAD	NAD
Location: C100CC - Row 47: Red Gasket								
120	ET5336AI48A	48	0.138	63.9	26.2	9.9	NAD	NAD
Location: C100JD - Row 48: White Fixture Caulk								
121	ET5336AI48B	48	0.157	64.1	30.8	5.2	NAD	NAD
Location: C100JD - Row 48: White Fixture Caulk								
122	ET5336AI49A	49	----	----	----	----	NAD	NA
Location: C100JD - Row 49: Off-White Terrazzo								
123	ET5336AI49B	49	----	----	----	----	NAD	NA
Location: C100JB - Row 49: Off-White Terrazzo								
124	ET5336AI50A	50	0.151	24.1	73.6	2.2	NAD	NAD
Location: C1026A - Row 50: White Sink Caulk								
125	ET5336AI50B	50	0.143	23.4	59.4	17.3	NAD	NAD
Location: C1026A - Row 50: White Sink Caulk								
126	ET5336AI51A	51	0.277	24.1	74.3	1.6	NAD	NAD
Location: C100CJ - Row 51: White Caulk								
127	ET5336AI51B	51	0.120	60.8	17.6	21.7	NAD	NAD
Location: C100CF - Row 51: White Caulk								
128	ET5336AI52A	52	0.159	23.2	43.2	33.6	NAD	NAD
Location: C100CJ - Row 52: White Interface Caulk								

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AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
129	ET5336AI52B	52	0.161	22.4	30.4	47.2	NAD	NAD
Location: C100CF - Row 52: White Interface Caulk								
130	ET5336AI53A	53	0.207	31.9	37.7	30.4	NAD	NAD
Location: C100CJ - Row 53: White Window Perimeter Caulk								
131	ET5336AI53B	53	0.172	38.3	32.7	29.0	NAD	NAD
Location: C100CJ - Row 53: White Window Perimeter Caulk								
132	ET5336AI54A	54	0.107	34.0	25.9	40.1	NAD	NAD
Location: C100CJ - Row 54: White Caulk								
133	ET5336AI54B	54	0.257	41.0	40.2	18.7	NAD	NAD
Location: C100CJ - Row 54: White Caulk								
134	ET5336AI55A	55	0.154	36.7	41.8	21.5	NAD	NAD
Location: C100CJ - Row 55: White Pipe TSI End Sealant								
135	ET5336AI55B	55	0.273	36.2	49.4	14.4	NAD	NAD
Location: C100CJ - Row 55: White Pipe TSI End Sealant								
136	ET5336AI55C	55	0.183	52.4	32.6	15.1	NAD	NAD
Location: C100CP - Row 55: While Pipe TSI End Sealant								
137	ET5336AI56A	56	0.170	29.8	59.2	11.0	NAD	NAD
Location: C1005 - Row 56: White Caulk								
138	ET5336AI56B	56	0.283	24.7	71.2	4.1	NAD	NAD
Location: C1011 - Row 56: White Caulk								
139	ET5336AI57A	57	0.027	95.2	3.0	1.9	NAD	NAD
Location: CT1023 - Row 57: Black Gasket								
140	ET5336AI57B	57	0.014	87.1	11.4	1.4	NAD	NAD
Location: CT1018 - Row 57: Black Gasket								
141	ET5336AI58A	58	0.244	42.4	41.3	16.4	NAD	NAD
Location: C1005 - Row 58: White Caulk								
142	ET5336AI58B	58	0.202	33.9	53.5	12.7	NAD	NAD
Location: C1011 - Row 58: White Caulk								
143	ET5336AI59A	59	----	----	----	----	NAD	NA
Location: C100JB - Row 59: Light Gray Cementitious Wall Patch								
144	ET5336AI59B	59	----	----	----	----	NAD	NA
Location: C100JB - Row 59: Light Gray Cementitious Wall Patch								

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AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
145	ET5336AI60A	60	----	----	----	----	NAD	NA
Location: C1018 - Row 60: White CWT Grout								
146	ET5336AI60B	60	----	----	----	----	NAD	NA
Location: C1018 - Row 60: White CWT Grout								
147	ET5336AI61A	61	0.266	29.0	66.6	4.4	NAD	NAD
Location: C1018 - Row 61: CWT Adhesive								
148	ET5336AI61B	61	0.156	22.3	64.8	12.9	NAD	NAD
Location: C1018 - Row 61: CWT Adhesive								
149	ET5336AI62A	62	----	----	----	----	NAD	NA
Location: C1018 - Row 62: Gray CFT Grout								
150	ET5336AI62B	62	----	----	----	----	NAD	NA
Location: C1018 - Row 62: Gray CFT Grout								
151	ET5336AI63A	63	----	----	----	----	NAD	NA
Location: C1018 - Row 63: CFT Mortar Row 62								
152	ET5336AI63B	63	----	----	----	----	NAD	NA
Location: C1018 - Row 63: CFT Mortar Row 62								
153	ET5336AI64A	64	0.193	61.8	6.2	32.0	NAD	NAD
Location: C1018 - Row 64: Silver Caulk								
154	ET5336AI64B	64	0.278	61.8	9.7	28.5	NAD	NAD
Location: C1018 - Row 64: Silver Caulk								
155	ET5336AI65A	65	0.245	28.0	69.2	2.8	NAD	NAD
Location: C1018 - Row 65: White Caulk								
156	ET5336AI65B	65	0.147	27.8	68.2	4.0	NAD	NAD
Location: C1018 - Row 65: White Caulk								
157	ET5336AI66A	66	----	----	----	----	NAD	NA
Location: C1014 - Row 66: Brown CFT Grout								
158	ET5336AI66B	66	----	----	----	----	NAD	NA
Location: C1014 - Row 66: Brown CFT Grout								
159	ET5336AI67A	67	----	----	----	----	NAD	NA
Location: C1014 - Row 67: CFT Mortar Row 66								
160	ET5336AI67B	67	----	----	----	----	NAD	NA
Location: C1014 - Row 67: CFT Mortar Row 66								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
161	ET5336AI68A	68	----	----	----	----	NAD	NA
Location: C1008 - Row 68: White 8-Inch Diameter Pipe TSI Jacket								
162	ET5336AI68B	68	----	----	----	----	NAD	NA
Location: C1008 - Row 68: White 8-Inch Diameter Pipe TSI Jacket								
163	ET5336AI68C	68	----	----	----	----	NAD	NA
Location: C1008 - Row 68: White 8-Inch Diameter Pipe TSI Jacket								
164	ET5336AI69A	69	0.161	20.1	3.5	76.4	NAD	NAD
Location: C1014 - Row 69: Off-White Sink Coating								
165	ET5336AI69B	69	0.116	15.6	5.7	78.7	NAD	NAD
Location: C1014 - Row 69: Off-White Sink Coating								
166	ET5336AI69C	69	0.119	16.0	4.5	79.4	NAD	NAD
Location: C1014 - Row 69: Off-White Sink Coating								
167	ET5336AI70A	70	0.201	40.6	38.3	21.2	NAD	NAD
Location: C1014 - Row 70: White Adhesive								
168	ET5336AI70B	70	0.195	41.0	19.9	39.0	NAD	NAD
Location: C1014 - Row 70: White Adhesive								
169	ET5336AI71A	71	----	----	----	----	NAD	NA
Location: C1014 - Row 71: White 4-Inch Diameter Pipe TSI Jacket								
170	ET5336AI71B	71	----	----	----	----	NAD	NA
Location: C1014 - Row 71: White 4-Inch Diameter Pipe TSI Jacket								
171	ET5336AI71C	71	----	----	----	----	NAD	NA
Location: C1014 - Row 71: White 4-Inch Diameter Pipe TSI Jacket								
172	ET5336AI72A	72	0.221	55.0	34.6	10.4	NAD	NAD
Location: C1014 - Row 72: White Pipe TSI End Sealant								
173	ET5336AI72B	72	0.168	53.5	33.2	13.3	NAD	NAD
Location: C1014 - Row 72: White Pipe TSI End Sealant								
174	ET5336AI72C	72	0.259	45.5	2.7	51.8	NAD	NAD
Location: C1014 - Row 72: White Pipe TSI End Sealant								
175	ET5336AI73A	73	0.136	55.0	6.8	38.1	NAD	NAD
Location: C1014 - Row 73: Clear HVAC Seam Sealant								
176	ET5336AI73B	73	0.092	64.6	30.7	4.7	NAD	NAD
Location: C1014 - Row 73: Clear HVAC Seam Sealant								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
177	ET5336AI74A	74	0.121	35.7	41.7	22.6	NAD	NAD
Location: C100CD - Row 74: White Pipe TSI End Sealant								
178	ET5336AI74B	74	0.117	37.0	45.0	18.0	NAD	NAD
Location: C100CF - Row 74: White Pipe TSI End Sealant								
179	ET5336AI74C	74	0.283	43.3	44.7	12.0	NAD	NAD
Location: C100CM - Row 74: White Pipe TSI End Sealant								
180	ET5336AI75A	75	0.158	28.3	68.4	3.4	NAD	NAD
Location: C1021 - Row 75: White Caulk								
181	ET5336AI75B	75	0.138	37.8	35.2	27.0	NAD	NAD
Location: C1023 - Row 75: White Caulk								
182	ET5336AI76A	76	0.151	66.2	22.5	11.3	NAD	NAD
Location: C1022 - Row 76: Gray Caulk								
183	ET5336AI76B	76	0.231	65.0	27.2	7.9	NAD	NAD
Location: C1022 - Row 76: Gray Caulk								
184	ET5336AI77A	77	0.119	57.9	20.8	21.4	NAD	NAD
Location: C1021 - Row 77: White Caulk								
185	ET5336AI77B	77	0.078	68.5	17.5	14.0	NAD	NAD
Location: C1020 - Row 77: White Caulk								
186	ET5336AI78A	78	0.204	62.5	17.5	20.0	NAD	NAD
Location: C1021 - Row 78: Clear Caulk								
187	ET5336AI78B	78	0.080	67.1	8.6	24.3	NAD	NAD
Location: C1020 - Row 78: Clear Caulk								
188	ET5336AI79A	79	0.100	63.4	7.5	29.1	NAD	NAD
Location: C1021 - Row 79: Silver Caulk								
189	ET5336AI79B	79	0.318	67.1	21.9	10.9	NAD	NAD
Location: C1020 - Row 79: Silver Caulk								
190	ET5336AI80A	80	----	----	----	----	NA	NA
Location: C1020 - Row 80: White Window Glazing "Insufficient Material Submitted For Preparation"								
191	ET5336AI80B	80	0.050	88.5	9.5	2.0	NAD	NAD
Location: C1017 - Row 80: White Window Glazing								
192	ET5336AI81A	81	0.321	16.0	79.5	4.4	NAD	NAD
Location: C100CH - Row 81: Gray 12- By 12-Inch Speckled Floor Tile								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
193	ET5336AI81B	81	0.265	15.4	79.9	4.6	NAD	NAD
Location: C1019 - Row 81: Gray 12- By 12-Inch Speckled Floor Tile								
194	ET5336AI82A	82	0.120	71.9	15.6	12.5	NAD	NAD
Location: C100CH - Row 82: Black Mastic								
195	ET5336AI82B	82	0.120	59.5	20.5	20.1	NAD	NAD
Location: C1019 - Row 82: Black Mastic								
196	ET5336AI83A	83	0.339	16.3	70.0	13.7	NAD	NAD
Location: C100CH - Row 83: Light Blue 12- By 12-Inch Speckled Floor Tile								
197	ET5336AI83B	83	0.280	17.2	76.1	6.7	NAD	NAD
Location: C100CH - Row 83: Light Blue 12- By 12-Inch Speckled Floor Tile								
198	ET5336AI84A	84	0.230	63.0	12.7	24.3	NAD	NAD
Location: C100CH - Row 84: Yellow Mastic								
199	ET5336AI84B	84	0.278	63.9	17.8	18.4	NAD	NAD
Location: C100CH - Row 84: Yellow Mastic								
200	ET5336AI85A	85	0.269	16.3	77.7	6.0	NAD	NAD
Location: C100CH - Row 85: Black 12- By 12-Inch Floor Tile								
201	ET5336AI85B	85	0.289	17.5	69.4	13.0	NAD	NAD
Location: C100CH - Row 85: Black 12- By 12-Inch Floor Tile								
202	ET5336AI86A	86	0.143	36.1	50.7	13.2	NAD	NAD
Location: C100CH - Row 86: Yellow Mastic								
203	ET5336AI86B	86	0.142	39.9	28.8	31.3	NAD	NAD
Location: C100CH - Row 86: Yellow Mastic								
204	ET5336AI87A	87	0.145	77.0	16.9	6.1	NAD	NAD
Location: C100CH - Row 87: Light Gray Door Frame Caulk								
205	ET5336AI87B	87	0.125	71.3	20.6	8.1	NAD	NAD
Location: C100CH - Row 87: Light Gray Door Frame Caulk								
206	ET5336AI88A	88	0.222	41.6	57.3	1.1	NAD	NAD
Location: C100CH - Row 88: Black 6-Inch Diameter Cove Base								
207	ET5336AI88B	88	0.234	41.4	57.6	1.0	NAD	NAD
Location: C100CH - Row 88: Black 6-Inch Diameter Cove Base								
208	ET5336AI89A	89	0.130	30.4	13.3	56.3	NAD	NAD
Location: C100CH - Row 89: Beige Adhesive								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
209	ET5336AI89B	89	0.069	28.7	30.1	41.2	NAD	NAD
Location: C100CH - Row 89: Beige Adhesive								
210	ET5336AI90A	90	----	----	----	----	NAD	NA
Location: C100CH - Row 90: Light Gray CWT Mortar								
211	ET5336AI90B	90	----	----	----	----	NAD	NA
Location: C100CH - Row 90: Light Gray CWT Mortar								
212	ET5336AI91A	91	0.188	48.0	37.1	14.9	NAD	NAD
Location: C1019 - Row 91: Black Door Light Butyl								
213	ET5336AI91B	91	0.115	54.1	36.0	9.9	NAD	NAD
Location: C1019 - Row 91: Black Door Light Butyl								
214	ET5336AI92A	92	0.197	17.9	77.9	4.3	NAD	NAD
Location: C1019 - Row 92: Beige 12- By 12-Inch Speckled Floor Tile								
215	ET5336AI92B	92	0.227	17.9	78.1	4.1	NAD	NAD
Location: C1019 - Row 92: Beige 12- By 12-Inch Speckled Floor Tile								
216	ET5336AI93A	93	0.167	28.6	38.6	32.8	NAD	NAD
Location: C1019 - Row 93: Yellow Mastic								
217	ET5336AI93B	93	0.145	29.9	28.5	41.6	NAD	NAD
Location: C1019 - Row 93: Yellow Mastic								
218	ET5336AI94A	94	0.237	36.0	34.4	29.6	NAD	NAD
Location: C1019 - Row 94: White Window Frame Caulk								
219	ET5336AI94B	94	0.179	41.0	26.4	32.6	NAD	NAD
Location: C1019 - Row 94: White Window Frame Caulk								
220	ET5336AI95A	95	0.161	44.4	28.7	27.0	NAD	NAD
Location: C1019 - Row 95: Black Window Glazing								
221	ET5336AI95B	95	0.104	45.7	26.5	27.8	NAD	NAD
Location: C1017 - Row 95: Black Window Glazing								
222	ET5336AI96A	96	0.085	16.2	9.7	74.1	NAD	NAD
Location: C100CG - Row 96: Off-White 2- By 4-Foot Textured Ceiling Tile								
223	E15336AI96B	96	0.261	16.0	20.8	63.2	NAD	NAD
Location: C100CP - Row 96: Off-White 2- By 4-Foot Textured Ceiling Tile								
224	ET5336AI97A	97	0.095	17.5	31.3	51.2	NAD	NAD
Location: C100CG - Row 97: Beige 2- By 4-Foot Textured Ceiling Tile								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
225	ET5336AI97B	97	0.124	15.7	41.1	43.2	NAD	NAD
Location: C100CP - Row 97: Beige 2- By 4-Foot Textured Ceiling Tile								
226	ET5336AI98A	98	0.163	29.3	68.3	2.5	NAD	NAD
Location: T100TA - Row 98: White Fixture Caulk								
227	ET5336AI98B	98	0.177	26.8	71.5	1.7	NAD	NAD
Location: T100TB - Row 98: White Fixture Caulk								
228	ET5336AI100A	100	0.085	50.4	37.4	12.2	NAD	NAD
Location: C100CP - Row 100: Black Door Light Butyl								
229	ET5336AI100B	100	0.222	45.4	40.1	14.5	NAD	NAD
Location: C100CP - Row 100: Black Door Light Butyl								
230	ET5336AI101A	101	0.190	32.6	16.4	50.9	NAD	NAD
Location: C100CD - Row 101: White Door Frame Caulk								
231	ET5336AI101B	101	0.075	33.4	42.8	23.7	NAD	NAD
Location: C100CD - Row 101: White Door Frame Caulk								
232	ET5336AI102A	102	0.222	72.2	20.3	7.5	NAD	NAD
Location: C1015 - Row 102: Off-White Caulk								
233	ET5336AI102B	102	0.200	72.9	20.4	6.7	NAD	NAD
Location: C1015 - Row 102: Off-White Caulk								
234	ET5336AI103A	103	----	----	----	----	NAD	NA
Location: C100TB - Row 103: Off-White Gypsum Ceiling Board								
235	ET5336AI103B	103	----	----	----	----	NAD	NA
Location: C100TB - Row 103: Off-White Gypsum Ceiling Board								
236	ET5336AI104A	104	----	----	----	----	NAD	NA
Location: C100TB - Row 104: White Joint Compound Row 103								
237	ET5336AI104B	104	----	----	----	----	NAD	NA
Location: C100TB - Row 104: White Joint Compound Row 103								
238	ET5336AI104C	104	----	----	----	----	NAD	NA
Location: C100TB - Row 104: White Joint Compound Row 103								
239	ET5336AI105A	105	----	----	----	----	NAD	NA
Location: C100TB - Row 105: White Seam Tape Row 103								
240	ET5336AI105B	105	----	----	----	----	NAD	NA
Location: C100TB - Row 105: White Seam Tape Row 103								

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Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
241	ET5336AI106A	106	----	----	----	----	NAD	NA
Location:	C100CH - Row 106: White 10-Inch Diameter Pipe TSI Jacket							
242	ET5336AI106B	106	----	----	----	----	NAD	NA
Location:	C100CH - Row 106: White 10-Inch Diameter Pipe TSI Jacket							
243	ET5336AI106C	106	----	----	----	----	NAD	NA
Location:	C100CH - Row 106: White 10-Inch Diameter Pipe TSI Jacket							
244	ET5336AI107A	107	----	----	----	----	NAD	NA
Location:	C100CG - Row 107: Light Gray Flooring Material							
245	ET5336AI107B	107	----	----	----	----	NAD	NA
Location:	C100CD - Row 107: Light Gray Flooring Material							
246	ET5336AI108A	108	0.264	51.4	41.8	6.9	NAD	NAD
Location:	C1014 - Row 108: Off-White Residual Pipe TSI End Sealant							
247	ET5336AI108B	108	0.235	50.2	40.6	9.2	NAD	NAD
Location:	C1014 - Row 108: Off-White Residual Pipe TSI End Sealant							
248	ET5336AI108C	108	0.272	50.2	38.9	10.9	NAD	NAD
Location:	C1014 - Row 108: Off-White Residual Pipe TSI End Sealant							
249	ET5336AI109A	109	0.095	6.5	14.9	78.6	NAD	NAD
Location:	C1014 - Row 109: Gray Gasket							
250	ET5336AI109B	109	0.060	13.6	3.8	82.6	NAD	NAD
Location:	C1014 - Row 109: Gray Gasket							
251	ET5336AI110A	110	0.159	26.0	71.8	2.2	NAD	NAD
Location:	C1017 - Row 110: White Door Frame Caulk							
252	ET5336AI110B	110	0.281	26.3	71.0	2.7	NAD	NAD
Location:	C100CF - Row 110: White Door Frame Caulk							
253	ET5336AI111A	111	----	----	----	----	NAD	NA
Location:	C100CP - Row 111: Beige Flooring Material							
254	ET5336AI111B	111	----	----	----	----	NAD	NA
Location:	C100CG - Row 111: Beige Flooring Material							
255	ET5336AI112A	112	----	----	----	----	NAD	NA
Location:	C100CD - Row 112: Dark Gray Flooring Material							
256	ET5336AI112B	112	----	----	----	----	NAD	NA
Location:	C100CF - Row 112: Dark Gray Flooring Material							

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Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
257	ET5336AI113A	113	----	----	----	----	NAD	NA
Location: C100CD - Row 113: Dark Gray Flooring Material								
258	ET5336AI113B	113	----	----	----	----	NAD	NA
Location: C100CD - Row 113: Dark Gray Flooring Material								
259	ET5336AI114A	114	0.104	72.5	11.2	16.4	NAD	NAD
Location: C1032 - Row 114: Black Residual Flooring Material								
260	ET5336AI114B	114	0.154	69.0	9.1	21.9	NAD	NAD
Location: C1032 - Row 114: Black Residual Flooring Material								
261	ET5336AI115A	115	0.178	43.9	21.1	35.0	NAD	NAD
Location: C1032 - Row 115: White Gasket								
262	ET5336AI115B	115	0.221	45.8	28.4	25.8	NAD	NAD
Location: C1032 - Row 115: White Gasket								
263	ET5336AI116A	116	0.229	48.7	35.1	16.2	NAD	NAD
Location: C1032 - Row 116: Gray Gasket								
264	ET5336AI116B	116	0.277	49.5	32.8	17.7	NAD	NAD
Location: C1032 - Row 116: Gray Gasket								
265	ET5336AI117A	117	----	----	----	----	NAD	NA
Location: C1015 - Row 117: Brown Fire Door Insulation								
266	ET5336AI117B	117	----	----	----	----	NAD	NA
Location: C1014 - Row 117: Brown Fire Door Insulation								
267	ET5336AI117C	117	----	----	----	----	NAD	NA
Location: C1018 - Row 117: Brown Fire Door Insulation								
268	ET5336AI118A	118	----	----	----	----	NAD	NA
Location: C1017 - Row 118: Off-White Fire Door Insulation								
269	ET5336AI118B	118	----	----	----	----	NAD	NA
Location: C100CG - Row 118: Off-White Fire Door Insulation								
270	ET5336AI118C	118	----	----	----	----	NAD	NA
Location: C10OCJ - Row 118: Off-White Fire Door Insulation								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Transgenic Mouse Care Facility (TMCF) Swing Space; Ithaca, New York

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM

Analyzed by: Hongyan Ran
Date: 4/18/2024

Reviewed by: Karol H. Lu

**Quantitative Analysis (Semi/Full); Bulk Asbestos Analysis - PLM by Appd E to Subpt E, 40 CFR 763 or NYSDOH ELAP 198.1 for New York friable samples or NYSDOH ELAP 198.6 for New York NOB samples; TEM (Semi/Full) by EPA 600/R-93/116 (or NYSDOH ELAP 198.4; for New York samples). Analysis using Hitachi, Model H600-Noran 7 System, Microscope, Serial #: 600-27-6. NAD = no asbestos detected during a quantitative analysis; NA = not analyzed; Trace = <1%; (SOF-V) = Sprayed On Fireproofing containing Vermiculite; (SM-V) = Surfacing Material containing Vermiculite; Quantitation for beginning weights of <0.1 grams should be considered as qualitative only; Qualitative Analysis: Asbestos analysis results of "Present" or "NVA = No Visible Asbestos" represents results for Qualitative PLM or TEM Analysis only (no accreditation coverage available from any regulatory agency for qualitative analyses): NVLAP (PLM) 200546-0, NYSDOH ELAP Lab 11480, NJ Lab ID #NY031.

Warning Note: PLM limitation, only TEM will resolve fibers <0.25 micrometers in diameter. TEM bulk analysis is representative of the fine grained matrix material and may not be representative of non-uniformly dispersed debris for which PLM evaluation is recommended (i.e. soils and other heterogenous materials).

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

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315-786-2022 (F)
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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 1 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI01A	C100CJ	Row 1: White Gypsum Ceiling Board	X			
04/04/2024	ET5336AI01B	C100CF	Row 1: White Gypsum Ceiling Board	X			
04/04/2024	ET5336AI02A	C100CJ	Row 2: White Joint Compound Row 1	X			
04/04/2024	ET5336AI02B	C100CF	Row 2: White Joint Compound Row 1	X			
04/04/2024	ET5336AI02C	C100CF	Row 2: White Joint Compound Row 1	X			
04/04/2024	ET5336AI04A	C100CF	Row 4: White Door Frame Caulk		X	X	
04/04/2024	ET5336AI04B	C100CP	Row 4: White Door Frame Caulk		X	X	
04/04/2024	ET5336AI05A	C100CF	Row 5: White Interface Caulk		X	X	
04/04/2024	ET5336AI05B	C1017	Row 5: White Interface Caulk		X	X	
04/04/2024	ET5336AI06A	C100CF	Row 6: Black Door Light Butyl		X	X	

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24	Name: Fed Ex Date: 4/15/24	
Signature: [signature] Time: 1715	Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M.Villatoro Date: 4/16/24	
Signature: Time:	Signature: M.Vill Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

224042319

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

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labsCT@atlantictesting.com

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Utica NY 13501
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315-735-0742 (F)
labsUT@atlantictesting.com

Watertown
26581 NYS Route 283
Watertown, NY 13601
315-786-7887 (T)
315-786-2022 (F)
labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 2 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI06B	C100CJ	Row 6: Black Door Light Butyl		X	X	
04/04/2024	ET5336AI07A	C100CJ	Row 7: Light Gray Block Mortar		X	X	
04/04/2024	ET5336AI07B	C100CM	Row 7: Light Gray Block Mortar		X	X	
04/04/2024	ET5336AI08A	C100CJ	Row 8: White Penetration Caulk		X	X	
04/04/2024	ET5336AI08B	C100CJ	Row 8: White Penetration Caulk		X	X	
04/04/2024	ET5336AI09A	C100CM	Row 9: Dark Red Fire Stop Sealant		X	X	
04/04/2024	ET5336AI09B	C100CG	Row 9: Dark Red Fire Stop Sealant		X	X	
04/04/2024	ET5336AI10A	C100CM	Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI10B	C100CM	Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI10C	C100CM	Row 10: Off-White 4-Inch Diameter Pipe TSI Jacket	X			

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Potham Date: 4/15/24 Signature: Time: 1717	Name: Date: 4/15/24 Signature: Fed Ex Time: 1800	224042319
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M.Villatoro Date: 4/16/24 Signature: M.Vill Time: 12:00	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET@atlantictesting.com	**Page Number:** 3 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI11A	C100CJ	Row 11: White 4-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI11B	C100CM	Row 11: White 4-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI11C	C100CD	Row 11: White 4-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI12A	C1032	Row 12: Black Interface Caulk		X	X	
04/05/2024	ET5336AI12B	C1032	Row 12: Black Interface Caulk		X	X	
04/15/2024	ET5336AI13A	C100CH	Row 13: White Spray-Applied Fire Proofing	X			
04/15/2024	ET5336AI13B	C100CH	Row 13: White Spray-Applied Fire Proofing	X			
04/15/2024	ET5336AI13C	C100CG	Row 13: White Spray-Applied Fire Proofing	X			
04/15/2024	ET5336AI13D	C100CG	Row 13: White Spray-Applied Fire Proofing	X			
04/15/2024	ET5336AI13E	C100CD	Row 13: White Spray-Applied Fire Proofing	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	224042319
Signature: Time: 1718	Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villadero Date: 4/16/24	
Signature: Time:	Signature: Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany
22 Corporate Drive
Clifton Park, NY 12065
518-383-9144 (T)
518-383-9166 (F)
labsAT@atlantictesting.com

Binghamton
126 Park Avenue
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315-786-2022 (F)
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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 4 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/15/2024	ET5336AI13F	C100CD	Row 13: White Spray-Applied Fire Proofing	X			
04/15/2024	ET5336AI13G	C100CJ	Row 13: White Spray-Applied Fire Proofing	X			
04/04/2024	ET5336AI14A	C100CP	Row 14: White Expansion Joint Caulk		X	X	
04/04/2024	ET5336AI14B	C100CJ	Row 14: White Expansion Joint Caulk		X	X	
04/04/2024	ET5336AI15A	C100CJ	Row 15: Light Gray HVAC Seam Sealant		X	X	
04/04/2024	ET5336AI15B	C100CM	Row 15: Light Gray HVAC Seam Sealant		X	X	
04/04/2024	ET5336AI16A	C100CJ	Row 16: Silver HVAC TSI Jacket	X			
04/04/2024	ET5336AI16B	C100CM	Row 16: Silver HVAC TSI Jacket	X			
04/04/2024	ET5336AI16C	C100CD	Row 16: Silver HVAC TSI Jacket	X			
04/05/2024	ET5336AI17A	C100TE	Row 17: Off-White 2- by 4-Foot Fissured and Pinholed Ceiling Tile		X	X	

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24 Signature: DP Time: 1720	Name: Fed Date: 4/15/24 Signature: EK Time: 1800	224042319
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villatoro Date: 4/16/24 Signature: M. Vill Time: 12:00	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

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518-383-9166 (F)
labsAT@atlantictesting.com

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labsET@atlantictesting.com

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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 5 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI17B	C1039	Row 17: Off-White 2- by 4-Foot Fissured and Pinholed Ceiling Tile		X	X	
04/05/2024	ET5336AI18A	C1032	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI18B	C1032	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI18C	C1037	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI18D	C1037	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI18E	C100TE	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI18F	C1039	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI18G	C1038	Row 18: Off-White Skim Coat Wall Plaster	X			
04/05/2024	ET5336AI19A	C1032	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			
04/05/2024	ET5336AI19B	C1032	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1721	Name: Fed Ex Date: 4/15/24 Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villatoro Date: 4/16/24 Signature: Time: 12:00	224042319
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

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ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

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Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 6 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
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Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI19C	C1037	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			
04/05/2024	ET5336AI19D	C1037	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			
04/05/2024	ET5336AI19E	C100TE	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			
04/05/2024	ET5336AI19F	C1039	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			
04/05/2024	ET5336AI19G	C1038	Row 19: Light Gray Base Coat Wall Plaster Row 18	X			
04/05/2024	ET5336AI20A	C100CD	Row 20: White 6-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI20B	C100CF	Row 20: White 6-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI20C	C100CM	Row 20: White 6-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI21A	C1032	Row 21: Off-White Insulation Backing Row 18	X			
04/05/2024	ET5336AI21B	C1032	Row 21: Off-White Insulation Backing Row 18	X			

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: Time: 1722	Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M.Villatoro Date: 4/16/24	224042319
Signature: Time:	Signature: M.V Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
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518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 7 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
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Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI21C	C1039	Row 21: Off-White Insulation Backing Row 18	X			
04/05/2024	ET5336AI22A	C1032	Row 22: White Gypsum Wall Board		X	X	
04/05/2024	ET5336AI22B	C100CM	Row 22: White Gypsum Wall Board		X	X	
04/05/2024	ET5336AI23A	C1032	Row 23: White Joint Compound Row 22	X			
04/05/2024	ET5336AI23B	C1032	Row 23: White Joint Compound Row 22	X			
04/05/2024	ET5336AI23C	C100CM	Row 23: White Joint Compound Row 22	X			
04/04/2024	ET5336AI25A	C1005	Row 25: Black 4-Inch Diameter Cove Base		X	X	
04/04/2024	ET5336AI25B	C1005A	Row 25: Black 4-Inch Diameter Cove Base		X	X	
04/04/2024	ET5336AI26A	C1005	Row 26: Beige Adhesive		X	X	
04/04/2024	ET5336AI26B	C1005A	Row 26: Beige Adhesive		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: [signature] Time: 1724	Name: Fed Ex Date: 4/15/24 Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villatoro Date: 4/16/24 Signature: [signature] Time: 12:00	224042319
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
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Project Manager: Andrew S. Amell	**Email Results:** labsET@atlantictesting.com	**Page Number:** 8 of 27

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Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI27A	C1032	Row 27: Black Window Butyl		X	X	
04/05/2024	ET5336AI27B	C1032	Row 27: Black Window Butyl		X	X	
04/05/2024	ET5336AI28A	C1032	Row 28: Black Countertop	X			
04/05/2024	ET5336AI28B	C1032	Row 28: Black Countertop	X			
04/05/2024	ET5336AI29A	C1036	Row 29: Clear Door Light Butyl		X	X	
04/05/2024	ET5336AI29B	C1036	Row 29: Clear Door Light Butyl		X	X	
04/05/2024	ET5336AI30A	C1036	Row 30: Clear Window Butyl		X	X	
04/05/2024	ET5336AI30B	C1036	Row 30: Clear Window Butyl		X	X	
04/04/2024	ET5336AI31A	C1037	Row 31: White 2-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI31B	C1037	Row 31: White 2-Inch Diameter Pipe TSI Jacket	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: [signature] Time: 1725	Signature: Ed Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villafane Date: 4/16/24	224042319
Signature: Time:	Signature: M. Vill Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

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ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 9 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI31C	C1037	Row 31: White 2-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI32A	C1037	Row 32: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI32B	C1037	Row 32: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI32C	C1037	Row 32: White Pipe TSI End Sealant	X			
04/05/2024	ET5336AI33A	C1032	Row 33: Off-White Countertop Seam Sealant		X	X	
04/05/2024	ET5336AI33B	C1037	Row 33: Off-White Countertop Seam Sealant		X	X	
04/04/2024	ET5336AI34A	C1037	Row 34: Black Sink Coating	X			
04/04/2024	ET5336AI34B	C1032	Row 34: Black Sink Coating	X			
04/04/2024	ET5336AI35A	C1037	Row 35: White Caulk		X	X	
04/04/2024	ET5336AI35B	C1032	Row 35: White Caulk		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1726	Name: Fed Ex Date: 4/15/24 Signature: Time: 1800	224042319
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villalobos Date: 4/16/24 Signature: M. Vall Time: 12:00	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

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ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 10 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI36A	C1032	Row 36: Black Adhesive Row 28		X	X	
04/05/2024	ET5336AI36B	C1036	Row 36: Black Adhesive Row 28		X	X	
04/05/2024	ET5336AI37A	C1032	Row 37: Dark Gray HVAC Seam Sealant		X	X	
04/05/2024	ET5336AI37B	C1032	Row 37: Dark Gray HVAC Seam Sealant		X	X	
04/04/2024	ET5336AI38A	C100CD	Row 38: White 10-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI38B	C100CF	Row 38: White 10-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI38C	C1017	Row 38: White 10-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI39A	C1017	Row 39: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI39B	C1017	Row 39: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI39C	C1017	Row 39: White Pipe TSI End Sealant	X			

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1727	Name: Fed Date: 4/15/24 Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villatoro Date: 4/16/24 Signature: M. Vill Time: 12:00	2240423 19
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 11 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI40A	C1032	Row 40: White Caulk		X	X	
04/05/2024	ET5336AI40B	C1020	Row 40: White Caulk		X	X	
04/05/2024	ET5336AI41A	C1032	Row 41: Gray Fire Stop Sealant		X	X	
04/05/2024	ET5336AI41B	C1032	Row 41: Gray Fire Stop Sealant		X	X	
04/04/2024	ET5336AI42A	C1032	Row 42: Black Caulk Row 28	X			
04/04/2024	ET5336AI42B	C1032	Row 42: Black Caulk Row 28	X			
04/05/2024	ET5336AI43A	C1032	Row 43: White 4-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI43B	C1032	Row 43: White 4-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI43C	C1032	Row 43: White 4-Inch Diameter Pipe TSI Jacket	X			
04/05/2024	ET5336AI44A	C1032	Row 44: White Pipe TSI End Sealant	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: [redacted] Dylan Pitman Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: [redacted] Time: 1727	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villatoro Date: 4/16/24	224042319
Signature: Time:	Signature: M.V Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 12 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI44B	C1032	Row 44: White Pipe TSI End Sealant	X			
04/05/2024	ET5336AI44C	C1032	Row 44: White Pipe TSI End Sealant	X			
04/05/2024	ET5336AI45A	C1032	Row 45: Silver HVAC TSI Jacket	X			
04/05/2024	ET5336AI45B	C1032	Row 45: Silver HVAC TSI Jacket	X			
04/05/2024	ET5336AI45C	C1032	Row 45: Silver HVAC TSI Jacket	X			
04/05/2024	ET5336AI46A	C100CC	Row 46: Silver Caulk		X	X	
04/05/2024	ET5336AI46B	C100CC	Row 46: Silver Caulk		X	X	
04/05/2024	ET5336AI47A	C100CC	Row 47: Red Gasket	X			
04/05/2024	ET5336AI47B	C100CC	Row 47: Red Gasket	X			
04/04/2024	ET5336AI48A	C100JD	Row 48: White Fixture Caulk		X	X	

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putram Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: [signature] Time: 1728	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M.Villatoro Date: 4/16/24	
Signature: Time:	Signature: M.Vill Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

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Project Manager: Andrew S. Amell	**Email Results:** labs ET @atlantictesting.com	**Page Number:** 13 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
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Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI48B	C100JD	Row 48: White Fixture Caulk		X	X	
04/04/2024	ET5336AI49A	C100JD	Row 49: Off-White Terrazzo	X			
04/04/2024	ET5336AI49B	C100JB	Row 49: Off-White Terrazzo	X			
04/05/2024	ET5336AI50A	C1026A	Row 50: White Sink Caulk		X	X	
04/05/2024	ET5336AI50B	C1026A	Row 50: White Sink Caulk		X	X	
04/04/2024	ET5336AI51A	C100CJ	Row 51: White Caulk		X	X	
04/04/2024	ET5336AI51B	C100CF	Row 51: White Caulk		X	X	
04/04/2024	ET5336AI52A	C100CJ	Row 52: White Interface Caulk		X	X	
04/04/2024	ET5336AI52B	C100CF	Row 52: White Interface Caulk		X	X	
04/04/2024	ET5336AI53A	C100CJ	Row 53: White Window Perimeter Caulk		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1729	Name: Fed Date: 4/15/24 Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villaton Date: 4/16/24 Signature: M. Vill Time: 12:00	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	224042319

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Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 14 of 27

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Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI53B	C100CJ	Row 53: White Window Perimeter Caulk		X	X	
04/04/2024	ET5336AI54A	C100CJ	Row 54: White Caulk		X	X	
04/04/2024	ET5336AI54B	C100CJ	Row 54: White Caulk		X	X	
04/04/2024	ET5336AI55A	C100CJ	Row 55: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI55B	C100CJ	Row 55: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI55C	C100CP	Row 55: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI56A	C1005	Row 56: White Caulk		X	X	
04/04/2024	ET5336AI56B	C1011	Row 56: White Caulk		X	X	
04/04/2024	ET5336AI57A	CT1023	Row 57: Black Gasket		X	X	
04/04/2024	ET5336AI57B	CT1018	Row 57: Black Gasket		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: DP Time: 1730	Name: Fed Date: 4/15/24 Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villafane Date: 4/16/24 Signature: M.V Time: 1200	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

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Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 15 of 27

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Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI58A	C1005	Row 58: White Caulk		X	X	
04/04/2024	ET5336AI58B	C1011	Row 58: White Caulk		X	X	
04/04/2024	ET5336AI59A	C100JB	Row 59: Light Gray Cementitious Wall Patch	X			
04/04/2024	ET5336AI59B	C100JB	Row 59: Light Gray Cementitious Wall Patch	X			
04/04/2024	ET5336AI60A	C1018	Row 60: White CWT Grout	X			
04/04/2024	ET5336AI60B	C1018	Row 60: White CWT Grout	X			
04/04/2024	ET5336AI61A	C1018	Row 61: CWT Adhesive	X			
04/04/2024	ET5336AI61B	C1018	Row 61: CWT Adhesive	X			
04/04/2024	ET5336AI62A	C1018	Row 62: Gray CFT Grout	X			
04/04/2024	ET5336AI62B	C1018	Row 62: Gray CFT Grout	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: [signature] Time: 1731	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villafane Date: 4/16/24	
Signature: Time:	Signature: [signature] Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

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ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany
22 Corporate Drive
Clifton Park, NY 12065
518-383-9144 (T)
518-383-9166 (F)
labsAT@atlantictesting.com

Binghamton
126 Park Avenue
Binghamton, NY 13903
607-773-1812 (T)
607-773-1835 (F)
labsET@atlantictesting.com

Canton
6431 U.S. Highway 11
Canton, NY 13617
315-386-4578 (T)
315-386-1012 (F)
labsCT@atlantictesting.com

Plattsburgh
130 Arizona Ave
Plattsburgh, NY 12903
518-563-5878 (T)
518-562-1321 (F)
labsPL@atlantictesting.com

Poughkeepsie
251 Upper North Road
Highland, NY 12528
845-691-6098 (T)
845-691-6099 (F)
labsPT@atlantictesting.com

Rochester
3495 Winton Place
Rochester, NY 14623
585-427-9020 (T)
585-427-9021 (F)
labsRT@atlantictesting.com

Syracuse
6085 Court Street Road
Syracuse, NY 13206
315-699-5281 (T)
315-699-3374 (F)
labsST@atlantictesting.com

Utica
301 St. Anthony Street
Utica NY 13501
315-735-3309 (T)
315-735-0742 (F)
labsUT@atlantictesting.com

Watertown
26581 NYS Route 283
Watertown, NY 13601
315-786-7887 (T)
315-786-2022 (F)
labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 16 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI63A	C1018	Row 63: CFT Mortar Row 62	X			
04/04/2024	ET5336AI63B	C1018	Row 63: CFT Mortar Row 62	X			
04/04/2024	ET5336AI64A	C1018	Row 64: Silver Caulk		X	X	
04/04/2024	ET5336AI64B	C1018	Row 64: Silver Caulk		X	X	
04/04/2024	ET5336AI65A	C1018	Row 65: White Caulk		X	X	
04/04/2024	ET5336AI65B	C1018	Row 65: White Caulk		X	X	
04/04/2024	ET5336AI66A	C1014	Row 66: Brown CFT Grout	X			
04/04/2024	ET5336AI66B	C1014	Row 66: Brown CFT Grout	X			
04/04/2024	ET5336AI67A	C1014	Row 67: CFT Mortar Row 66	X			
04/04/2024	ET5336AI67B	C1014	Row 67: CFT Mortar Row 66	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Ex Date: 4/15/24	
Signature: Time: 1732	Signature: Time: 1860	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M.Villatoro Date: 4/16/24	
Signature: Time:	Signature: Time: 1200	
Name: Date:	Name: Date:	224042319
Signature: Time:	Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany
22 Corporate Drive
Clifton Park, NY 12065
518-383-9144 (T)
518-383-9166 (F)
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Binghamton, NY 13903
607-773-1812 (T)
607-773-1835 (F)
labsET@atlantictesting.com

Canton
6431 U.S. Highway 11
Canton, NY 13617
315-386-4578 (T)
315-386-1012 (F)
labsCT@atlantictesting.com

Plattsburgh
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518-563-5878 (T)
518-562-1321 (F)
labsPL@atlantictesting.com

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845-691-6099 (F)
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labsRT@atlantictesting.com

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Syracuse, NY 13206
315-699-5281 (T)
315-699-3374 (F)
labsST@atlantictesting.com

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315-735-0742 (F)
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Watertown
26581 NYS Route 283
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315-786-7887 (T)
315-786-2022 (F)
labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labs ET @atlantictesting.com	**Page Number:** 17 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI68A	C1008	Row 68: White 8-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI68B	C1008	Row 68: White 8-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI68C	C1008	Row 68: White 8-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI69A	C1014	Row 69: Off-White Sink Coating	X			
04/04/2024	ET5336AI69B	C1014	Row 69: Off-White Sink Coating	X			
04/04/2024	ET5336AI69C	C1014	Row 69: Off-White Sink Coating	X			
04/04/2024	ET5336AI70A	C1014	Row 70: White Adhesive		X	X	
04/04/2024	ET5336AI70B	C1014	Row 70: White Adhesive		X	X	
04/04/2024	ET5336AI71A	C1014	Row 71: White 4-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI71B	C1014	Row 71: White 4-Inch Diameter Pipe TSI Jacket	X			

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	224042319
Signature: [signature] Time: 1733	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villatoro Date: 4/16/24	
Signature: Time:	Signature: M. V Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labs ET @atlantictesting.com	**Page Number:** 18 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis	☒ If negative by PLM-NOB, analyze by TEM-NOB	☐ Other:		

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI71C	C1014	Row 71: White 4-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI72A	C1014	Row 72: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI72B	C1014	Row 72: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI72C	C1014	Row 72: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI73A	C1014	Row 73: Clear HVAC Seam Sealant		X	X	
04/04/2024	ET5336AI73B	C1014	Row 73: Clear HVAC Seam Sealant		X	X	
04/05/2024	ET5336AI74A	C100CD	Row 74: White Pipe TSI End Sealant	X			
04/05/2024	ET5336AI74B	C100CF	Row 74: White Pipe TSI End Sealant	X			
04/05/2024	ET5336AI74C	C100CM	Row 74: White Pipe TSI End Sealant	X			
04/04/2024	ET5336AI75A	C1021	Row 75: White Caulk		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: Time: 1733	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villatoro Date: 4/16/24	
Signature: Time:	Signature: M. V Time: 12:00	224042319
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET@atlantictesting.com	**Page Number:** 19 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI75B	C1023	Row 75: White Caulk		X	X	
04/04/2024	ET5336AI76A	C1022	Row 76: Gray Caulk		X	X	
04/04/2024	ET5336AI76B	C1022	Row 76: Gray Caulk		X	X	
04/04/2024	ET5336AI77A	C1021	Row 77: White Caulk		X	X	
04/04/2024	ET5336AI77B	C1020	Row 77: White Caulk		X	X	
04/04/2024	ET5336AI78A	C1021	Row 78: Clear Caulk		X	X	
04/04/2024	ET5336AI78B	C1020	Row 78: Clear Caulk		X	X	
04/04/2024	ET5336AI79A	C1021	Row 79: Silver Caulk		X	X	
04/04/2024	ET5336AI79B	C1020	Row 79: Silver Caulk		X	X	
04/04/2024	ET5336AI80A	C1020	Row 80: White Window Glazing		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: DP Time: 1734	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villatoro Date: 4/16/24	224042319
Signature: Time:	Signature: MV Time: 1200	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labs ET @atlantictesting.com	**Page Number:** 20 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI80B	C1017	Row 80: White Window Glazing		X	X	
04/04/2024	ET5336AI81A	C100CH	Row 81: Gray 12- by 12-Inch Speckled Floor Tile		X	X	
04/04/2024	ET5336AI81B	C1019	Row 81: Gray 12- by 12-Inch Speckled Floor Tile		X	X	
04/04/2024	ET5336AI82A	C100CH	Row 82: Black Mastic		X	X	
04/04/2024	ET5336AI82B	C1019	Row 82: Black Mastic		X	X	
04/04/2024	ET5336AI83A	C100CH	Row 83: Light Blue 12- by 12-Inch Speckled Floor Tile		X	X	
04/04/2024	ET5336AI83B	C100CH	Row 83: Light Blue 12- by 12-Inch Speckled Floor Tile		X	X	
04/04/2024	ET5336AI84A	C100CH	Row 84: Yellow Mastic		X	X	
04/04/2024	ET5336AI84B	C100CH	Row 84: Yellow Mastic		X	X	
04/04/2024	ET5336AI85A	C100CH	Row 85: Black 12- by 12-Inch Floor Tile		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1735	Name: Fed Date: 4/15/24 Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villafane Date: 4/16/24 Signature: M. Vill Time: 1200	224042319
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 21 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI85B	C100CH	Row 85: Black 12- by 12-Inch Floor Tile		X	X	
04/04/2024	ET5336AI86A	C100CH	Row 86: Yellow Mastic		X	X	
04/04/2024	ET5336AI86B	C100CH	Row 86: Yellow Mastic		X	X	
04/04/2024	ET5336AI87A	C100CH	Row 87: Light Gray Door Frame Caulk		X	X	
04/04/2024	ET5336AI87B	C100CH	Row 87: Light Gray Door Frame Caulk		X	X	
04/04/2024	ET5336AI88A	C100CH	Row 88: Black 6-Inch Diameter Cove Base		X	X	
04/04/2024	ET5336AI88B	C100CH	Row 88: Black 6-Inch Diameter Cove Base		X	X	
04/04/2024	ET5336AI89A	C100CH	Row 89: Beige Adhesive		X	X	
04/04/2024	ET5336AI89B	C100CH	Row 89: Beige Adhesive		X	X	
04/04/2024	ET5336AI90A	C100CH	Row 90: Light Gray CWT Mortar	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1736	Name: Fed Date: 4/15/24 Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villafane Date: 4/16/24 Signature: M.V Time: 12:00	224042319
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
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Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 22 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI90B	C100CH	Row 90: Light Gray CWT Mortar	X			
04/04/2024	ET5336AI91A	C1019	Row 91: Black Door Light Butyl		X	X	
04/04/2024	ET5336AI91B	C1019	Row 91: Black Door Light Butyl		X	X	
04/04/2024	ET5336AI92A	C1019	Row 92: Beige 12- by 12-Inch Speckled Floor Tile		X	X	
04/04/2024	ET5336AI92B	C1019	Row 92: Beige 12- by 12-Inch Speckled Floor Tile		X	X	
04/04/2024	ET5336AI93A	C1019	Row 93: Yellow Mastic		X	X	
04/04/2024	ET5336AI93B	C1019	Row 93: Yellow Mastic		X	X	
04/04/2024	ET5336AI94A	C1019	Row 94: White Window Frame Caulk		X	X	
04/04/2024	ET5336AI94B	C1019	Row 94: White Window Frame Caulk		X	X	
04/04/2024	ET5336AI95A	C1019	Row 95: Black Window Glazing		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: [illegible] Date: 4/15/24	
Signature: [signature] Time: 1738	Signature: [signature] Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villafane Date: 4/16/24	
Signature: Time:	Signature: [signature] Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	

224042319

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 23 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI95B	C1017	Row 95: Black Window Glazing		X	X	
04/04/2024	ET5336AI96A	C100CG	Row 96: Off-White 2- by 4-Foot Textured Ceiling Tile		X	X	
04/04/2024	ET5336AI96B	C100CP	Row 96: Off-White 2- by 4-Foot Textured Ceiling Tile		X	X	
04/04/2024	ET5336AI97A	C100CG	Row 97: Beige 2- by 4-Foot Textured Ceiling Tile	X			
04/04/2024	ET5336AI97B	C100CP	Row 97: Beige 2- by 4-Foot Textured Ceiling Tile	X			
04/04/2024	ET5336AI98A	T100TA	Row 98: White Fixture Caulk		X	X	
04/04/2024	ET5336AI98B	T100TB	Row 98: White Fixture Caulk		X	X	
04/04/2024	ET5336AI100A	C100CP	Row 100: Black Door Light Butyl		X	X	
04/04/2024	ET5336AI100B	C100CP	Row 100: Black Door Light Butyl		X	X	
04/04/2024	ET5336AI101A	C100CD	Row 101: White Door Frame Caulk		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1738	Name: Fed Date: 4/15/24 Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villafane Date: 4/16/24 Signature: Time: 12:00	224042319
Name: Date: Signature: Time:	Name: Date: Signature: Time:	

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany
22 Corporate Drive
Clifton Park, NY 12065
518-383-9144 (T)
518-383-9166 (F)
labsAT@atlantictesting.com

Binghamton
126 Park Avenue
Binghamton, NY 13903
607-773-1812 (T)
607-773-1835 (F)
labsET@atlantictesting.com

Canton
6431 U.S. Highway 11
Canton, NY 13617
315-386-4578 (T)
315-386-1012 (F)
labsCT@atlantictesting.com

Plattsburgh
130 Arizona Ave
Plattsburgh, NY 12903
518-563-5878 (T)
518-562-1321 (F)
labsPL@atlantictesting.com

Poughkeepsie
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845-691-6098 (T)
845-691-6099 (F)
labsPT@atlantictesting.com

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3495 Winton Place
Rochester, NY 14623
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585-427-9021 (F)
labsRT@atlantictesting.com

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315-699-3374 (F)
labsST@atlantictesting.com

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301 St. Anthony Street
Utica NY 13501
315-735-3309 (T)
315-735-0742 (F)
labsUT@atlantictesting.com

Watertown
26581 NYS Route 283
Watertown, NY 13601
315-786-7887 (T)
315-786-2022 (F)
labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 24 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI101B	C100CD	Row 101: White Door Frame Caulk		X	X	
04/04/2024	ET5336AI102A	C1015	Row 102: Off-White Caulk		X	X	
04/04/2024	ET5336AI102B	C1015	Row 102: Off-White Caulk		X	X	
04/05/2024	ET5336AI103A	C100TB	Row 103: Off-White Gypsum Ceiling Board	X			
04/05/2024	ET5336AI103B	C100TB	Row 103: Off-White Gypsum Ceiling Board	X			
04/05/2024	ET5336AI104A	C100TB	Row 104: White Joint Compound Row 103	X			
04/05/2024	ET5336AI104B	C100TB	Row 104: White Joint Compound Row 103	X			
04/05/2024	ET5336AI104C	C100TB	Row 104: White Joint Compound Row 103	X			
04/05/2024	ET5336AI105A	C100TB	Row 105: White Seam Tape Row 103	X			
04/05/2024	ET5336AI105B	C100TB	Row 105: White Seam Tape Row 103	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1739	Name: Fed Date: 4/15/24 Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M.Villafane Date: 4/16/24 Signature: M.V Time: 12:00	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	224042319

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labs ET @atlantictesting.com	**Page Number:** 25 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/15/2024	ET5336AI106A	C100CH	Row 106: White 10-Inch Diameter Pipe TSI Jacket	X			
04/15/2024	ET5336AI106B	C100CH	Row 106: White 10-Inch Diameter Pipe TSI Jacket	X			
04/15/2024	ET5336AI106C	C100CH	Row 106: White 10-Inch Diameter Pipe TSI Jacket	X			
04/04/2024	ET5336AI107A	C100CG	Row 107: Light Gray Flooring Material		X	X	
04/04/2024	ET5336AI107B	C100CD	Row 107: Light Gray Flooring Material		X	X	
04/04/2024	ET5336AI108A	C1014	Row 108: Off-White Residual Pipe TSI End Sealant	X			
04/04/2024	ET5336AI108B	C1014	Row 108: Off-White Residual Pipe TSI End Sealant	X			
04/04/2024	ET5336AI108C	C1014	Row 108: Off-White Residual Pipe TSI End Sealant	X			
04/04/2024	ET5336AI109A	C1014	Row 109: Gray Gasket	X			
04/04/2024	ET5336AI109B	C1014	Row 109: Gray Gasket	X			

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24 Signature: Time: 1740	Name: Fed Ex Date: 4/15/24 Signature: Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date: Signature: Time:	Name: M. Villatoro Date: 4/16/24 Signature: M. Vill Time: 12:00	
Name: Date: Signature: Time:	Name: Date: Signature: Time:	224042319

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany	Binghamton	Canton	Plattsburgh	Poughkeepsie	Rochester	Syracuse	Utica	Watertown
22 Corporate Drive	126 Park Avenue	6431 U.S. Highway 11	130 Arizona Ave	251 Upper North Road	3495 Winton Place	6085 Court Street Road	301 St. Anthony Street	26581 NYS Route 283
Clifton Park, NY 12065	Binghamton, NY 13903	Canton, NY 13617	Plattsburgh, NY 12903	Highland, NY 12528	Rochester, NY 14623	Syracuse, NY 13206	Utica NY 13501	Watertown, NY 13601
518-383-9144 (T)	607-773-1812 (T)	315-386-4578 (T)	518-563-5878 (T)	845-691-6098 (T)	585-427-9020 (T)	315-699-5281 (T)	315-735-3309 (T)	315-786-7887 (T)
518-383-9166 (F)	607-773-1835 (F)	315-386-1012 (F)	518-562-1321 (F)	845-691-6099 (F)	585-427-9021 (F)	315-699-3374 (F)	315-735-0742 (F)	315-786-2022 (F)
labsAT@atlantictesting.com	labsET@atlantictesting.com	labsCT@atlantictesting.com	labsPL@atlantictesting.com	labsPT@atlantictesting.com	labsRT@atlantictesting.com	labsST@atlantictesting.com	labsUT@atlantictesting.com	labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 26 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day ☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/04/2024	ET5336AI110A	C1017	Row 110: White Door Frame Caulk		X	X	
04/04/2024	ET5336AI110B	C100CF	Row 110: White Door Frame Caulk		X	X	
04/05/2024	ET5336AI111A	C100CP	Row 111: Beige Flooring Material		X	X	
04/05/2024	ET5336AI111B	C100CG	Row 111: Beige Flooring Material		X	X	
04/05/2024	ET5336AI112A	C100CD	Row 112: Dark Gray Flooring Material		X	X	
04/05/2024	ET5336AI112B	C100CF	Row 112: Dark Gray Flooring Material		X	X	
04/05/2024	ET5336AI113A	C100CD	Row 113: Dark Gray Flooring Material		X	X	
04/05/2024	ET5336AI113B	C100CD	Row 113: Dark Gray Flooring Material		X	X	
04/05/2024	ET5336AI114A	C1032	Row 114: Black Residual Flooring Material		X	X	
04/05/2024	ET5336AI114B	C1032	Row 114: Black Residual Flooring Material		X	X	

Sampler:	Laboratory:	Field and Laboratory Remarks:
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: Time: 1741	Signature: Ex Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villaseñor Date: 4/16/24	
Signature: Time:	Signature: M. Vill Time: 12:00	
Name: Date:	Name: Date:	
Signature: Time:	Signature: Time:	224042319

ATLANTIC TESTING LABORATORIES
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

Albany
22 Corporate Drive
Clifton Park, NY 12065
518-383-9144 (T)
518-383-9166 (F)
labsAT@atlantictesting.com

Binghamton
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Canton, NY 13617
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315-386-1012 (F)
labsCT@atlantictesting.com

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518-562-1321 (F)
labsPL@atlantictesting.com

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845-691-6098 (T)
845-691-6099 (F)
labsPT@atlantictesting.com

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585-427-9020 (T)
585-427-9021 (F)
labsRT@atlantictesting.com

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315-699-3374 (F)
labsST@atlantictesting.com

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301 St. Anthony Street
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315-735-3309 (T)
315-735-0742 (F)
labsUT@atlantictesting.com

Watertown
26581 NYS Route 283
Watertown, NY 13601
315-786-7887 (T)
315-786-2022 (F)
labsWT@atlantictesting.com

Project Number: ET5336	**Project Name:** Transgenic Mouse Care Facility (TMCF) Swing Space	**Project Location:** Ithaca, New York
Project Manager: Andrew S. Amell	**Email Results:** labsET @atlantictesting.com	**Page Number:** 27 of 27

Turn Around Time:	☐ 12 hr	☐ 24 hr	☐ 48 hr	☐ 72 hr	☒ 5 day	☐ Other:
Special Instructions:	☒ Positive Stop Analysis		☒ If negative by PLM-NOB, analyze by TEM-NOB		☐ Other:	

Date	Sample Number	Sample Location	Sample Description	PLM	PLM-NOB	TEM-NOB	Laboratory Sample ID Number
04/05/2024	ET5336AI115A	C1032	Row 115: White Gasket	X			
04/05/2024	ET5336AI115B	C1032	Row 115: White Gasket	X			
04/05/2024	ET5336AI116A	C1032	Row 116: Gray Gasket	X			
04/05/2024	ET5336AI116B	C1032	Row 116: Gray Gasket	X			
04/15/2024	ET5336AI117A	C1015	Row 117: Brown Fire Door Insulation	X			
04/15/2024	ET5336AI117B	C1014	Row 117: Brown Fire Door Insulation	X			
04/15/2024	ET5336AI117C	C1018	Row 117: Brown Fire Door Insulation	X			
04/15/2024	ET5336AI118A	C1017	Row 118: Off-White Fire Door Insulation	X			
04/15/2024	ET5336AI118B	C100CG	Row 118: Off-White Fire Door Insulation	X			
04/15/2024	ET5336AI118C	C100CJ	Row 118: Off-White Fire Door Insulation	X			

Sampler:	**Laboratory:**	**Field and Laboratory Remarks:**
Name: Dylan Putnam Date: 4/15/24	Name: Fed Date: 4/15/24	
Signature: [signature] Time: 1742	Signature: FX Time: 1800	
Samples Relinquished By:	**Samples Received By:**	
Name: Date:	Name: M. Villatoro Date: 4/16/24	
Signature: Time:	Signature: [signature] Time: 1200	
Name: Date:	Name: Date:	224042319
Signature: Time:	Signature: Time:	

AmeriSci New York
117 EAST 30TH ST.
NEW YORK, NY 10016
TEL: (212) 679-8600 • FAX: (212) 679-3114

PLM Bulk Asbestos Report

Atlantic Testing Laboratories, Limited
Attn: Andrew Amell
6431 US Highway 11

Canton, NY 13617

Date Received 04/19/24
Date Examined 04/23/24
ELAP # 11480
AmeriSci Job # 224042652
P.O. # 23825
Page 1 **of** 1
RE: ET5336; Mouse Core Facility Swing Space; Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
ET5336AI80A 80	224042652-01	***No***	NAD (by NYS ELAP 198.6) by Jared C. Clarke on 04/23/24

Location: C1020 - White Window Glazing

Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 3.6%

Reporting Notes:

Analyzed by: Jared C. Clarke
Date: 4/23/2024

Reviewed by: Karol H. Lu

*NAD/NSD =no asbestos detected; NA =not analyzed; NA/PS=not analyzed/positive stop, (SOF-V) = Sprayed On Fireproofing containing Vermiculite; (SM-V) = Surfacing Material containing Vermiculite; PLM Bulk Asbestos Analysis using Motic, Model BA310 Pol Scope, Microscope, Serial #: 1190000326, by Appd E to Subpt E, 40 CFR 763 quantified by either CVES or 400 pt ct as noted for each analysis (NVLAP 200546-0), ELAP PLM Method 198.1 for NY friable samples, which includes the identification and quantitation of vermiculite, or ELAP 198.6 for NOB samples, or EPA 400 pt ct by EPA 600-M4-82-020 (NY ELAP Lab 11480); Note:PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non asbestos-containing in NY State (also see EPA Advisory for floor tile, FR 59,146,38970,8/1/94) National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab.This PLM report relates ONLY to the items tested. RI Cert AAL-094, CT Cert PH-0186, Mass Cert AA000054, NJ Lab ID #NY031.

_____END OF REPORT_____

Client Name: Atlantic Testing Laboratories, Limited

Table I
Summary of Bulk Asbestos Analysis Results

ET5336; Mouse Core Facility Swing Space; Ithaca, NY

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
01	ET5336AI80A	80	0.041	78.7	17.7	3.6	NAD	NAD
Location: C1020 - White Window Glazing								

Analyzed by: Khaalid W. Perine

Date: 4/24/2024



Reviewed by: Karol H. Lu



**Quantitative Analysis (Semi/Full); Bulk Asbestos Analysis - PLM by Appd E to Subpt E, 40 CFR 763 or NYSDOH ELAP 198.1 for New York friable samples or NYSDOH ELAP 198.6 for New York NOB samples; TEM (Semi/Full) by EPA 600/R-93/116 (or NYSDOH ELAP 198.4; for New York samples). Analysis using Hitachi, Model H7000-Noran 7 System, Microscope, Serial #: 747-05-06. NAD = no asbestos detected during a quantitative analysis; NA = not analyzed; Trace = <1%; (SOF-V) = Sprayed On Fireproofing containing Vermiculite; (SM-V) = Surfacing Material containing Vermiculite; Quantitation for beginning weights of <0.1 grams should be considered as qualitative only; Qualitative Analysis: Asbestos analysis results of "Present" or "NVA = No Visible Asbestos" represents results for Qualitative PLM or TEM Analysis only (no accreditation coverage available from any regulatory agency for qualitative analyses): NVLAP (PLM) 200546-0, NYSDOH ELAP Lab 11480, NJ Lab ID #NY031.

Warning Note: PLM limitation, only TEM will resolve fibers <0.25 micrometers in diameter. TEM bulk analysis is representative of the fine grained matrix material and may not be representative of non-uniformly dispersed debris for which PLM evaluation is recommended (i.e. soils and other heterogenous materials).

2240426522

ATLANTIC TESTING LABORATORIES

ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY RECORD

№ 23825

Albany
22 Corporate Drive
Clifton Park, NY 12065
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518/383-9166 (F)
labsAT@atlantictesting.com

Binghamton
126 Park Avenue
Binghamton, NY 13903
607/773-1812 (T)
607/773-1835 (F)
labsET@atlantictesting.com

Canton
6431 U.S. Highway 11
Canton, NY 13617
315/386-4578 (T)
315/386-1012 (F)
labsCT@atlantictesting.com

Elmira
2330 Route 352
Elmira, NY 14903
607/737-0700 (T)
607/737-0714 (F)
labsHT@atlantictesting.com

Plattsburgh
130 Arizona Ave
Plattsburgh, NY 12903
518/563-5878 (T)
518/562-1321 (F)
labsPL@atlantictesting.com

Poughkeepsie
251 Upper North Road
Highland, NY 12528
845/691-6098 (T)
845/691-6099 (F)
labsPT@atlantictesting.com

Rochester
3495 Winton Place
Rochester, NY 14623
585/427-9020 (T)
585/427-9021 (F)
labsRT@atlantictesting.com

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315/699-3374 (F)
labsST@atlantictesting.com

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315/735-0742 (F)
labsUT@atlantictesting.com

Watertown
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Watertown, NY 13601
315/786-7887 (T)
315/786-2022 (F)
labsWT@atlantictesting.com

Project No.	Project Name	Date Collected
ET5336	Mouse Core Facility Swing Space	4/18/24 Page 1 of 1

Laboratory Instructions

Turn-Around-Time: ☐ 12hr ☐ 24hr ☐ 48hr ☐ 72hr ☒ 5day ☐ _____

Special Instructions: ☒ Positive Stop Analysis ☒ If negative by PLM-NOB, analyze by TEM-NOB ☐ Other _____

Report Distribution

Send Reports To (ATL Office): labsET@Atlantictesting.com

ATL Contact: A. Amell

Project Contact: Andrew Amell

Project Location: Ithaca, Ny

Send Copy To:

Email Results: @atlantictesting.com

Field Sample No.	Sample Location	Sample Description	Analysis Requested: PLM	PLM-NOB	TEM-NOB	TEM-ONLY	MICRO-VAC	Laboratory Sample ID No.
ET5336AI80A	C1020	White Window Glazing		X				

Sampler's Name: Dylan Putnam

Sampler's Signature:

Date: 4/18/24

Time: 1445

Received at Laboratory (Name):

Laboratory Signature:

Date:

Time:

Shipment Rec'd Intact ☐ YES ☐ NO

Samples Relinquished By:

Name	Date	Time
Dylan Putnam	4/18/24	1500

Samples Received By:

Name	Date	Time
Fed Ex	4/18/24	1500
	4/19/24	1050

Field and Laboratory Remarks:

Think Quality

Distribution: White with Samples
Yellow to Laboratory
Pink to ATL Files

APPENDIX D

SUMMARY TABLES

KEY FOR SUMMARY TABLES

Acronyms for the Known or Assumed ACM:

CFT = Ceramic Floor Tile
CWT = Ceramic Wall Tile
EPDM = Ethylene Propylene Diene Monomer
HVAC = Heating, Ventilation, and Air Conditioning
TSI = Thermal System Insulation
CMU = Concrete Masonry Unit

Abbreviations for Friable/ACM Type:

Y = Yes N= No M = Miscellaneous S = Surfacing T = Thermal System Insulation

Descriptions for Conditions:

The listed conditions of Good, Fair, and Poor generally correspond with the AHERA descriptions of Good, Damaged, and Significantly Damaged for different types of materials. The following summarizes additional details relative to the listed conditions.

Surfacing (Surf.) and Miscellaneous (Misc.) Materials

- Good: Material with no visible damage or deterioration, or showing only very limited damage or deterioration
- Fair: Material with characteristics of surface crumbling, blistered, water-stained, gouged, marred, or otherwise abraded over less than one tenth of the surface if the damage is evenly distributed or one quarter if the damage is localized.
- Poor: Material with one or more of the following characteristics:
  - Surface crumbling or blistering is present over at least one tenth of the surface, if the damage is evenly distributed or one quarter if the damage is localized.
  - One tenth (or one quarter, if localized) of material hanging from the surface, deteriorated, or showing adhesive failure.
  - Water stains, gouges, or mars over at least one tenth of the surface if the damage is evenly distributed or one quarter if the damage is localized.

Thermal System Insulation (TSI) Materials

- Good: Material with no visible damage or deterioration, or showing only very limited damage or deterioration
- Fair: Material with one or more of the following characteristics:
  - A few water stains or less than one tenth of insulation with missing jackets.
  - Crushed insulation or water stains, gouges, punctures, or mars on up to one tenth of the insulation if the damage is evenly distributed or up to one quarter if the damage is localized.
- Poor: Material with one or more of the following characteristics:
  - Missing jackets on at least one tenth of the piping or equipment.
  - Crushed or heavily gouged or punctured insulation on at least one tenth of the component (pipe runs/risers, boiler, tank, duct, etc.) if the damage is evenly distributed or one quarter if the damage is localized.

Notes:

[1] Sample Location Plans are enclosed in Appendix B.

[2] NAD = No Asbestos Detected.

[3] Quantities and locations are approximate and must be verified by asbestos abatement contractors prior to providing actual cost quotations and/or initiating abatement activities.

[4] NA = Not Applicable

Table D-I

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Newer White Gypsum Ceiling Board	Room Nos. C100CL, C100CM, C1033, C1035, C1036, C1037, C1032, C100CC, C100JD, C100CK, C1025, C100CJ, C1029, C1029A, C1029B, C1003, C1010A, C1010, C1009, C1011, C1005, C1005A, C1027, C1027A, C1028, C1028A, C1002, C1002A, C1001, C1018, C1006, C1008, C1008A, C1026A, C1026, C1014, C1023, C1021, C1020, C100CH, C1019, C100TA, C1017, C1015, C1013, C100JB, C100TB, C100JC, C100CF, C1081, and C100CD	Y / M	NAD	Good	ET5336AI01A ET5336AI01B	NA
White Joint Compound Associated with White Gypsum Ceiling Board	Room Nos. C100CL, C100CM, C1033, C1035, C1036, C1037, C1032, C100CC, C100JD, C100CK, C1025, C100CJ, C1029, C1029A, C1029B, C1003, C1010A, C1010, C1009, C1011, C1005, C1005A, C1027, C1027A, C1028, C1028A, C1002, C1002A, C1001, C1018, C1006, C1008, C1008A, C1026A, C1026, C1014, C1023, C1021, C1020, C100CH, C1019, C100TA, C1017, C1015, C1013, C100JB, C100TB, C100JC, C100CF, C1081, and C100CD	Y / M	NAD	Good	ET5336AI02A ET5336AI02B ET5336AI02C	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
White Door Frame Caulk	Room Nos. C100CL, C100CM, C100TE, C1039, C1038, C100CC, C100CK, C100JD, C100CJ, C1010A, C1003, C1010, C1009, C1011, C1005, C1005A, C1002, C1002A, C1001, C1018, C1006, C1008, C1008A, C1014, C1023, C1021, C1020, C100CH, C1019, C100CG, C100CP, C1015, C1013, C100JB, C100JC, C100CF, C100CD, and C1081	N / M	NAD	Good	ET5336AI04A ET5336AI04B	NA
White Ceiling to Wall Interface Caulk	Room Nos. C100CL, C100CM, C1033, C1036, C1035, C1037, C1032, C100CC, C100JD, C100CK, C1025, C100CJ, C1029, C1029A, C1029B, C1003, C1010A, C1010, C1009, C1011, C1005, C1005A, C1027, C1027A, C1028, C1028A, C1002, C1002A, C1001, C1018, C1006, C1008A, C1008, C1026A, C1026, C1014, C1023, C1021, C1020, C100CH, C1019, C100TA, C1017, C1015, C1013, C100JB, C100TB, C100JC, C100CF, and C1081	N / M	NAD	Good	ET5336AI05A ET5336AI05B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Black Door Light Butyl	Room Nos. C100CL, C100CM, C1033, C1035, C1037, C1032, C100CC, C100CK, C100CJ, C1029A, C1029B, C1003, C1010A, C1010, C1009, C1011, C1005, C1005A, C1027A, C1028A, C1002, C1002A, C1001, C1018, C1006, C1008A, C1008, C1026A, C1023, C100CH, C100CG, C100CP, C1017, C100CF, and C100CD	N / M	NAD	Fair	ET5336AI06A ET5336AI06B	NA
Light Gray CMU Block Mortar	Room Nos. C100CL, C100CM, C100TE, C1039, CT1038, C100CC, C100JD, C100CK, C100CJ, C1003, C1010A, C1010, C1009, C1011, C1005, C1005A, C1002, C1002A, C1001, C1018, C1006, C1008A, C1008, C1014, C1023, C1021, C1020, C1019, C100CG, C100CP, C1017, C1015, C1015A, C1013, C100JB, C100JC, C100CF, C100CD, and C1081	N / M	NAD	Good	ET5336AI07A ET5336AI07B	NA
White Pipe Penetration Caulk	Room Nos. C100CL, C1039, C1038, C1033, C1035, C1036, C1037, C1032, C100JD, C100CK, C100CJ, C1029A, C1029, C1029B, C1005A, C1027, C1027A, C1028, C1028A, C1002A, C1008A, C1026, C1026A, C1021, C1020, and C1017	N / M	NAD	Fair	ET5336AI08A ET5336AI08B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Dark Red Fire Stop Sealant	Room Nos. C100CM, C1039, C1038, C1036, C1032, C100CC, C100CK, C1025, C100CJ, C1022, C1029A, C1029B, C1003, C1011, C1005, C1027A, C1027, C1028A, C1028, C1018, C1008, C1006, C1008A, C014, C100CH, C100CG, and C100CD	N / M	NAD	Fair	ET5336AI09A ET5336AI09B	NA
Off-White 4-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room Nos. C100CM and C100CC	Y / T	NAD	Fair	ET5336AI10A ET5336AI10B ET5336AI10C	NA
White 4-Inch and 6-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room Nos. C100CM, C100TE, C1039, C1038, C100CC, C100CK, C1025, C100CJ, C1022, C1029, C1029A, C1029B, C1027, C1028, C1011, C1005, C1027A, C1028A, C1002A, C1018, C1006, C1008A, C1008, C1026, C1014, C100CP, C1013, C100CH, C100CG, C100JB, C100TB, C100CF, and C100CD (Domestic Water Line)	Y / T	NAD	Fair	ET5336AI11A ET5336AI11B ET5336AI11C	NA
Black Wall and Ceiling Interface Caulk	Room Nos. C100CM, C1036, C1032, C100CC, C100CK, C100CJ, C1028, and C1006	N / M	NAD	Fair	ET5336AI12A ET5336AI12B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
White Spray-Applied Fireproofing	Room Nos. C100CM, C100TE, C1039, C1038, C1033, C1036, C1032, C100CC, C100CK, C1025, C100CJ, C1022, C1029A, C1029B, C1003, C1011, C1005, C1027A, C1027, C1028A, C1028, C1002, C1002A, C1018, C1006, C1008A, C1008, C1014, C100CH, C1015A, C1013, and C100CD	Y / S	NAD	Fair	ET5336AI13A ET5336AI13B ET5336AI13C ET5336AI13D ET5336AI13E ET5336AI13F ET5336AI13G	NA
White Expansion Joint Caulk	Room Nos. C100CM, C1032, C100CC, C1025, C100CJ, C1005, C1028A, C1014, C1019, C100CG, C100CP, C1017, C100CF, and C100CD	N / M	NAD	Good	ET5336AI14A ET5336AI14B	NA
Light Gray HVAC Seam Sealant	Room Nos. C100CM, C1038, C1033, C1037, C100CC, C1014, C100CH, and C1015A	N / M	NAD	Good	ET5336AI15A ET5336AI15B	NA
Silver HVAC TSI Jacket Associated with Yellow Fiberglass	Room Nos. C10038, C10039, C100TE, C1033, C1036, C1037, C1032, C100CC, C100CK, C1025, C100CJ, C1029A, C1029B, C1003, C1011, C1005, C1027A, C1027, C1028A, C1028, C1002, C1002A, C1018, C1006, C1008A, C1008, C1014, C1020, C100CH, C100CG, C1019, C100CP, C1017, C1015A, C1013, C100CF, and C100CD	Y / T	NAD	Fair	ET5336AI16A ET5336AI16B ET5336AI16C	NA
Off-White 2-by 4-Foot Fissured and Pinholed Ceiling Tile	Room Nos. C100TE, C1039, and C1038	Y / M	NAD	Good	ET5336AI17A ET5336AI17B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Off-White Skim Coat Wall Plaster	Room Nos. C100TE, C1039, C1038, C1033, C1035, C1036, C1037, C1032, C1025, C1029, C1029A, C1029B, C1027, C1027A, C1028, C1028A, C1018, C1026, C1026A, and C1014	Y / S	NAD	Fair	ET5336AI18A ET5336AI18B ET5336AI18C ET5336AI18D ET5336AI18E ET5336AI18F ET5336AI18G	NA
Light Gray Base Coat Wall Plaster	Room Nos. C100TE, C1039, C1038, C1033, C1035, C1036, C1037, C1032, C1025, C1029, C1029A, C1029B, C1027, C1027A, C1028, C1028A, C1018, C1026, C1026A, and C1014	Y / S	NAD	Fair	ET5336AI19A ET5336AI19B ET5336AI19C ET5336AI19D ET5336AI19E ET5336AI19F ET5336AI19G	NA
White 6-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room Nos. C100CM, C1039, C1033, C1037, C1014, C1020, C1017, C100CF, and C100CD (Heating Water Supply)	Y / T	NAD	Fair	ET5336AI20A ET5336AI20B ET5336AI20C	NA
Off-White Cloth Associated with White Skim Coat Plaster	Room Nos. C100TE, C1039, C1038, C1033, C1035, C1036, C1037, C1032, C1025, C1029, C1029A, C1029B, C1027, C1027A, C1028, C1028A, C1018, C1026, C1026A, and C1014	Y / M	NAD	Fair	ET5336AI21A ET5336AI21B ET5336AI21C	NA
White Repair Gypsum Wall Board	Room Nos. C100CM, C1033, C1034, C1032, C100CJ, C1005, C1005A, C1023, C1021, C1020, and C100CH	N / M	NAD	Good	ET5336AI22A ET5336AI22B	NA
White Joint Compound Associated with White Repair Gypsum Wall Board	Room Nos. C100CM, C1033, C1034, C1032, C100CJ, C1005, C1005A, C1023, C1021, C1020, and C100CH	Y / M	NAD	Good	ET5336AI23A ET5336AI23B ET5336AI23C	NA
Black 4-Inch Cove Base	Room Nos. C100CM, C1033, C1034, C1032, C1005, C1005A, C1018, C1008, C1023, and C1019	N / M	NAD	Good	ET5336AI25A ET5336AI25B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Beige Adhesive Associated with Black 4-Inch Cove Base	Room Nos. C100CM, C1033, C1034, C1032, C1005, C1005A, C1018, C1008, C1023, and C1019	N / M	NAD	Good	ET5336AI26A ET5336AI26B	NA
Black Window Butyl	Room Nos. C1033, C1036, C1032, and C100CJ	N / M	NAD	Fair	ET5336AI27A ET5336AI27B	NA
Black Lap Countertop	Room Nos. C1035, C1036, C1032, C1029A, C1029B, C1010A, C1011, C1027A, C1028A, and C1002A	N / M	NAD	Good	ET5336AI28A ET5336AI28B	NA
Clear Repair Door Light Butyl	Room Nos. C1034 and C1036	N / M	NAD	Fair	ET5336AI29A ET5336AI29B	NA
Clear Repair Window Glazing	Room No. C1036	N / M	NAD	Fair	ET5336AI30A ET5336AI30B	NA
White 2-Inch Diameter Pipe TSI Jacket Associated with Yellow Fiberglass	Room No. C1037	Y / T	NAD	Fair	ET5336AI31A ET5336AI31B ET5336AI31C	NA
White Pipe TSI End Sealant Associated with White 2-Inch Diameter Pipe TSI Jacket Associated with Yellow Fiberglass	Room No. C1037	Y / M	NAD	Fair	ET5336AI32A ET5336AI32B ET5336AI32C	NA
Off-White Seam Sealant Associated with Stainless Steel Countertop	Room Nos. C1037, C1032, C1008, C1005A, and C1023	N / M	NAD	Fair	ET5336AI33A ET5336AI33B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Black Sink Coating	Room Nos. C1037, C1032, and C1023	N / M	NAD	Good	ET5336AI34A ET5336AI34B	NA
White Caulk Associated with Cabinets	Room Nos. C1037, C1032, C1008, C1027A, C1028A, C1029A, C1029B, C1010A, and C1005A	N / M	NAD	Good	ET5336AI35A ET5336AI35B	NA
Black Adhesive Associated with Black Lap Countertop	Room Nos. C1035, C1036, C1032, C1029A, C1029B, C1010A, C1011, C1027A, C1028A, and C1002A	N / M	NAD	Good	ET5336AI36A ET5336AI36B	NA
Dark Gray HVAC Seam Sealant	Room Nos. C1032 and C1020	N / M	NAD	Fair	ET5336AI37A ET5336AI37B	NA
White 1-Inch and 10-Inch Diameter Pipe TSI Jacket Associated with Yellow Fiberglass	Room Nos. C1032, C100CJ, C1018, C1008A, C1008, C1014, C1020, C1017, C1021, C1017, C100CF, C1015A, and C100CD (Condensate Lines)	Y / T	NAD	Fair	ET5336AI38A ET5336AI38B ET5336AI38C	NA
White Pipe TSI End Sealant Associated with White 1-Inch and 10-Inch Diameter Pipe TSI Jacket Associated with Yellow Fiberglass	Room Nos. C1032, C1008A, C1008, C1014, and C1017 (Condensate Lines)	Y / M	NAD	Fair	ET5336AI39A ET5336AI39B ET5336AI39C	NA
White Caulk Associated with Electrical Outlets	Room Nos. C1032, C1008A, C1017, and C1020	N / M	NAD	Fair	ET5336AI40A ET5336AI40B	NA
Gray Repair Fire Stop Sealant	Room No. C1032	N / M	NAD	Fair	ET5336AI41A ET5336AI41B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Black Seam Epoxy Associated with Black Lap Countertop	Room Nos. C1035, C1036, C1032, C1029A, C1029B, C1010A, C1011, C1027A, C1028A, and C1002A	N / M	NAD	Fair	ET5336AI42A ET5336AI42B	NA
White 4-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room Nos. C1032, C100JB, and C1015A (Steam Line)	Y / T	NAD	Fair	ET5336AI43A ET5336AI43B ET5336AI43C	NA
White Pipe TSI End Sealant Associated with the White 4-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room No. C10032 (Steam Line)	Y / M	NAD	Fair	ET5336AI44A ET5336AI44B ET5336AI44C	NA
Silver HVAC TSI Jacket Associated with Yellow Fiberglass Associated with Autoclave	Room No. C1032	Y / T	NAD	Fair	ET5336AI45A ET5336AI45B ET5336AI45C	NA
Silver Comingled with Clear Caulk Associated with Autoclave and Pipes	Room Nos. C100CC, C1014, and C1015	N / M	NAD	Fair	ET5336AI46A ET5336AI46B	NA
Red Gasket Associated with Autoclave	Room No. C100CC	N / M	NAD	Fair	ET5336AI47A ET5336AI47B	NA
White Shower Caulk	Room No. C100JD	N / M	NAD	Fair	ET5336AI48A ET5336AI48B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Off-White, with Black and Gray Speckled Terrazzo	Room Nos. T100JD and T100JB	N / M	NAD	Fair	ET5336AI49A ET5336AI49B	NA
White Sink Caulk	Room Nos. C1025, C1010A, C1002A, C1005A, C1008, and C1026A	N / M	NAD	Fair	ET5336AI50A ET5336AI50B	NA
White Caulk Associated with Key Card Panel and Electric Outlet	Room Nos. C100CJ, C100CF, and C100CD	N / M	NAD	Fair	ET5336AI51A ET5336AI51B	NA
White Wall Interface Caulk	Room Nos. C100CJ, C1018, C1001, C1002A, C1002, C1003, C1006, C1008, C1008A, C1005, C1005A, C1011, C1010, C1010A, C1009, C100CM, C1014, C1021, C100CP, C1017, C1015, C100JB, C100JC, C100CF, and C100CD	N / M	NAD	Good	ET5336AI52A ET5336AI52B	NA
White Window Perimeter Caulk	Room No. C100CJ	N / M	NAD	Good	ET5336AI53A ET5336AI53B	NA
White Caulk Associated with Autoclave	Room No. C100CJ	N / M	NAD	Good	ET5336AI54A ET5336AI54B	NA
White Pipe TSI End Sealant Associated with the White 4-Inch and 6-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room Nos. C100CJ, C1029, C1027, C1002A, C1028, C1018, C1006, C1026A, C1014, C100CP, C1013, and C100CF (Domestic Water Line)	Y / M	NAD	Fair	ET5336AI55A ET5336AI55B ET5336AI55C	NA
White Penetration Caulk Associated with HVAC	Room Nos. C1003, C1010, C1009, C1011, C1005, C1002, C1001, C1006, and C1008A	N / M	NAD	Fair	ET5336AI56A ET5336AI56B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Black Gasket Associated with Electrical Outlets	Room Nos. C1003, C1011, C1005, C1002, C1001, C1006, C1008A, C1014, C1021, C100TA, C100CF, C100CD, C1023, C1018, C100CM, C100CL, C1039, C1038, C1037, C1036, C1035, C1033, C1032, C1005A, C1010A, C1010, C1009, C1013, C1015, C1008, C1002A, C1081, C100CC, C1029, C1029A, C1029B, C1028, C1028A, C1027, C1027A, C1026, C1026A, C1021, C1020, C100CH, C1019, C1017, C100CJ, C100CG, and C100CP	N / M	NAD	Fair	ET5336AI57A ET5336AI57B	NA
White Caulk Associated with Light Fixtures	Room Nos. C1010, C1009, C1011, C1005, C1005A, C1033, C1035, C1036, C1037, C1032, C1025, C1029, C1029A, C1029A, C1029B, C1003, C1010A, C1027, C1027A, C1028, C1028A, C1002, C1002A, C1001, C1018, C1006, C1008, C1008A, C1026A, C1014, C1023, C1021, C1020, C1019, C1017, C1015, C1013, and C1081	N / M	NAD	Fair	ET5336AI58A ET5336AI58B	NA
Light Gray Cementitious Wall Patch	Room Nos. C1027 and C100JB	Y / M	NAD	Fair	ET5336AI59A ET5336AI59B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
White Grout Associated with 4- by 4-Inch White, Black and Red CWT	Room Nos. C1018, C100TA, and C100TB	N / M	NAD	Good	ET5336AI60A ET5336AI60B	NA
Beige Adhesive Associated with 4-by 4-Inch White, Black and Red CWT	Room Nos. C1018, C100TA, and C100TB	N / M	NAD	Good	ET5336AI61A ET5336AI61B	NA
Gray Grout Associated with 8-by 8-Inch Dark Gray Speckled CFT	Room Nos. C1018, C100TA, and C100TB	N / M	NAD	Fair	ET5336AI62A ET5336AI62B	NA
Gray Mortar Associated with 8-by 8-Inch Dark Gray Speckled CFT	Room Nos. C1018, C100TA, and C100TB	N / M	NAD	Fair	ET5336AI63A ET5336AI63B	NA
Silver Caulk Associated with Metal Wall	Room No. C1018	N / M	NAD	Fair	ET5336AI64A ET5336AI64B	NA
White Caulk Associated with Dishwasher	Room No. C1018	N / M	NAD	Fair	ET5336AI65A ET5336AI65B	NA
Brown Grout Associated with 6-by 6-Inch CFT	Room Nos. C1018 and C1014	N / M	NAD	Fair	ET5336AI66A ET5336AI66B	NA
Gray Mortar Associated with 6-by 6-Inch CFT	Room Nos. C1018 and C1014	N / M	NAD	Fair	ET5336AI67A ET5336AI67B	NA
White 8-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room No. C1008 (Chilled Water Supply)	Y / T	NAD	Fair	ET5336AI68A ET5336AI68B ET5336AI68C	NA
Off-White Sink Coating	Room No. C1014	N / M	NAD	Good	ET5336AI69A ET5336AI69B ET5336AI69C	NA
White Adhesive Associated with Large Dishwasher	Room No. C1014	N / M	NAD	Good	ET5336AI70A ET5336AI70B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
White 2-Inch, 4-Inch, and 6-Inch Diameter Pipe TSI Jacket Associated with Yellow Fiberglass Insulation	Room No. C1014 (Dishwasher)	Y / T	NAD	Fair	ET5336AI71A ET5336AI71B ET5336AI71C	NA
White Pipe TSI End Sealant Associated with the White 2-Inch, 4-Inch, and 6-Inch Diameter Pipe TSI Jacket Associated with Yellow Fiberglass Insulation	Room No. C1014 (Dishwasher)	Y / M	NAD	Fair	ET5336AI72A ET5336AI72B ET5336AI72C	NA
Clear HVAC Seam Sealant	Room No. C1014	N / M	NAD	Fair	ET5336AI73A ET5336AI73B	NA
White Pipe TSI End Sealant White 6-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room Nos. C1014, C1020, C1017, C100CD, C100CF, and C100CM (Heating Water Supply)	Y / M	NAD	Fair	ET5336AI74A ET5336AI74B ET5336AI74C	NA
White Caulk Associated with Repair Gypsum Wall	Room Nos. C1023, C1021, and C100CJ	N / M	NAD	Good	ET5336AI75A ET5336AI75B	NA
Gray Caulk Associated with Electrical Conduits	Room No. C1022	N / M	NAD	Fair	ET5336AI76A ET5336AI76B	NA
White Caulk Associated with Laboratory Hood	Room Nos. C1021 and C1020	N / M	NAD	Good	ET5336AI77A ET5336AI77B	NA
Clear Repair Penetration Caulk	Room Nos. C1021 and C1020	N / M	NAD	Fair	ET5336AI78A ET5336AI78B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Silver Caulk Associated with Laboratory Hood	Room Nos. C1021 and C1020	N / M	NAD	Good	ET5336AI79A ET5336AI79B	NA
White Window Glazing Associated with Garage Doors	Room Nos. C1020 and C1017	N / M	NAD	Fair	ET5336AI80A ET5336AI80B	NA
Gray 12- by 12-Inch Black Speckled Floor Tile	Room Nos. C100CH and C1019	N / M	NAD	Good	ET5336AI81A ET5336AI81B	NA
Black Mastic Associated with the Gray 12- by 12-Inch Black Speckled Floor Tile	Room Nos. C100CH and C1019	N / M	NAD	Good	ET5336AI82A ET5336AI82B	NA
Light Blue 12- by 12-Inch Black Speckled Floor Tile	Room No. C100CH	N / M	NAD	Good	ET5336AI83A ET5336AI83B	NA
Yellow Mastic Associated with the Light Blue 12- by 12-Inch Black Speckled Floor Tile	Room No. C100CH	N / M	NAD	Good	ET5336AI84A ET5336AI84B	NA
Black 12- by 12-Inch Floor Tile	Room No. C100CH	N / M	NAD	Good	ET5336AI85A ET5336AI85B	NA
Yellow Mastic Associated with the Black 12- by 12-Inch Floor Tile	Room No. C100CH	N / M	NAD	Good	ET5336AI86A ET5336AI86B	NA
Light Gray Door Frame Caulk	Room No. C100CH (Exterior Door)	N / M	NAD	Good	ET5336AI87A ET5336AI87B	NA
Black 6-Inch Cove Base	Room No. C100CH	N / M	NAD	Good	ET5336AI88A ET5336AI88B	NA
Beige Adhesive Associated with the Black 6-Inch Cove Base	Room No. C100CH	N / M	NAD	Good	ET5336AI89A ET5336AI89B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Light Gray Mortar Associated with Off-White and Black 6-by 2-Inch and 6-by 6-Inch CWT	Room No. C100CH	N / M	NAD	Good	ET5336AI90A ET5336AI90B	NA
Black Door Light Butyl	Room No. C1019	N / M	NAD	Fair	ET5336AI91A ET5336AI91B	NA
Beige 12- by 12-Inch Black Speckled Floor Tile	Room No. C1019	N / M	NAD	Good	ET5336AI92A ET5336AI92B	NA
Yellow and White Comingled Mastic Associated with the Beige 12- by 12-Inch Black Speckled Floor Tile	Room No. C1019	N / M	NAD	Good	ET5336AI93A ET5336AI93B	NA
White Window Frame Caulk	Room No. C1019	N / M	NAD	Good	ET5336AI94A ET5336AI94B	NA
Black Window Glazing	Room Nos. C1019 and C1017	N / M	NAD	Fair	ET5336AI95A ET5336AI95B	NA
Off-White 2- by 4-Foot Grid Pattern Ceiling Tile	Room Nos. C100CG, C100CP, C100CF, and C100CD	Y / M	NAD	Fair	ET5336AI96A ET5336AI96B	NA
Beige 2- by 4-Foot Speckled Ceiling Tile	Room Nos. C100CG, C100CP, C100CF, and C100CD	Y / M	NAD	Fair	ET5336AI97A ET5336AI97B	NA
White Toilet Caulk	Room Nos. T100TA and T100TB	N / M	NAD	Fair	ET5336AI98A ET5336AI98B	NA
Black Door Light Butyl	Room Nos. C100CP and C100CF	N / M	NAD	Fair	ET5336AI100A ET5336AI100B	NA
White Door Frame Caulk	Room No. C100CD	N / M	NAD	Good	ET5336AI101A ET5336AI101B	NA
Off-White Floor Caulk Associated with Autoclave	Room No. C1015	N / M	NAD	Fair	ET5336AI102A ET5336AI102B	NA
Older Off-White Gypsum Ceiling Board	Room Nos. C100TB and C100JC (Behind Newer Gypsum Board)	Y / M	NAD	Fair	ET5336AI103A ET5336AI103B	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
White Joint Compound Associated with the Older Off-White Gypsum Ceiling Board	Room Nos. C100TB and C100JC (Behind Newer Gypsum Board)	Y / M	NAD	Fair	ET5336AI104A ET5336AI104B ET5336AI104C	NA
White Seam Tape Associated with the Older Off-White Gypsum Ceiling Board	Room Nos. C100TB and C100JC (Behind Newer Gypsum Board)	Y / M	NAD	Fair	ET5336AI105A ET5336AI105B	NA
White 10-Inch Diameter Pipe TSI Paper Jacket Associated with Yellow Fiberglass	Room No. C100CH (Roof Drain)	Y / T	NAD	Fair	ET5336AI106A ET5336AI106B ET5336AI106C	NA
Light Gray Epoxy Flooring	Room Nos. C100CL, C1039, C1038, C100CM, C1037, C1036, C1035, C1033, C1032, C1005, C1005A, C1011, C1010, C1010A, C1009, C100CF, C1013, C100JB, C1015, C100CC, C1029B, C1029, C1029A, C1028A, C1028, C1027A, C1027, C100CK, C100JD, C1026, C1026A, C1025, C100CJ, C1023, C1021, C1020, C100CG, C100CP, C1017, C100JC, C1008A, C1008, C1006, C1003, C1002, C1002A, C1001, C1081, and C100CD	N / M	NAD	Fair	ET5336AI107A ET5336AI107B	NA
Off-White Residual Pipe Valve End Sealant	Room No. C1014	Y / M	NAD	Fair	ET5336AI108A ET5336AI108B ET5336AI108C	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Gray Pipe Flange Gasket	Room No. C1014	Y / M	NAD	Fair	ET5336AI109A ET5336AI109B	NA
Older White Door Frame Caulk	Room Nos. C1017 and C100CF	N / M	NAD	Fair	ET5336AI110A ET5336AI110B	NA
Beige Repair Epoxy Flooring	Room Nos. C100CG, C100CP, and C1032	N / M	NAD	Fair	ET5336AI111A ET5336AI111B	NA
Dark Gray Repair Epoxy Flooring	Room Nos. C100CG, C100CF, C100CD, and C1032	N / M	NAD	Fair	ET5336AI112A ET5336AI112B	NA
Dark Gray Repair Epoxy Flooring	Room No. C100CD	N / M	NAD	Fair	ET5336AI113A ET5336AI113B	NA
Black Residual Flooring Material	Room No. C1032 (Beneath Autoclave)	N / M	NAD	Fair	ET5336AI114A ET5336AI114B	NA
White Gasket Associated with Autoclave	Room No. C1032	N / M	NAD	Good	ET5336AI115A ET5336AI115B	NA
Gray Gasket Associated with Autoclave Door	Room Nos. C1032 and C100CJ	N / M	NAD	Good	ET5336AI116A ET5336AI116B	NA
Brown Fire Door Insulation	Room Nos. C1021, C1020, C100CH, C100CP, C1018, C100TA, C100CF, C100CJ, C1011, C1010A, C1010, C1009, C1013, C1014, C1015, C1029B, C1029A, C1029, C1028A, C1028, C1027A, C1027, C1026A, C1025, C1005A, C1005, C100TE, C100CM, C1032, C1033, C1035, C1036, C1037, C1039, C1038, C100JD, C100CK, C100CL, C1008, C1006, C1003, C1002, C1002A, C1001, C1081, and C100CD	Y / M	NAD	Good	ET5336AI117A ET5336AI117B ET5336AI117C	NA

Table D-I (Continued)

Summary of Suspect ACM and Analytical Results

Material	General Location[1,3]	Friable/ ACM Type	% Asbestos[2]	Condition	Sample Numbers	Estimated Quantity[3, 4]
Off-White Fire Door Insulation	C100CH, C1017, C100CG, C1015, C1019, C1018, C1023, C100CK, C1014, C1013, C100CF, C1010, C1009, C1009A, C1011, C1038A, C1039A, C1039B, C1037A, C1008A, C1002A, C100JB, C100TB, and C100JC	Y / M	NAD	Good	ET5336AI118A ET5336AI118B ET5336AI118C	NA

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

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 cleanup 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.

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).

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. Any additional associated fees for permitting and regulatory fees due to changes in the Work shall be reconciled upon project completion per General Conditions Article 4 – Changes In 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:

2. 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

3. NYS Energy Code

    a. International Energy Conservation Code

    b. ASHRAE 90.1

    c. Energy Code Supplement

4. National Electric Code

5. Occupational Safety and Health Administration (OSHA).

6. Life Safety Code NFPA 101.

7. All local ordinances

8. 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 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.

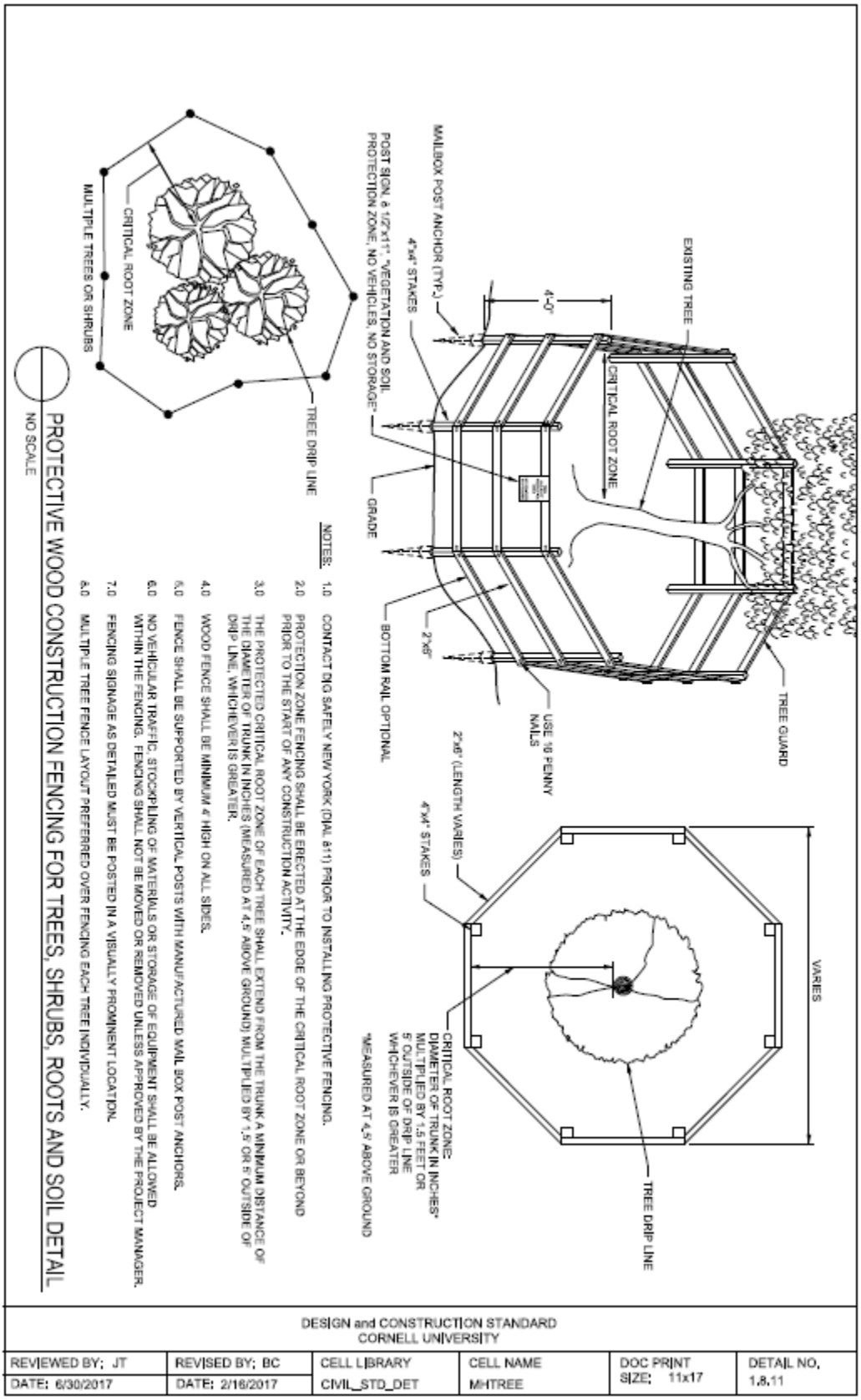
E. Carefully supervise excavating, grading and filling, and subsequent construction operations to prevent damage.

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.

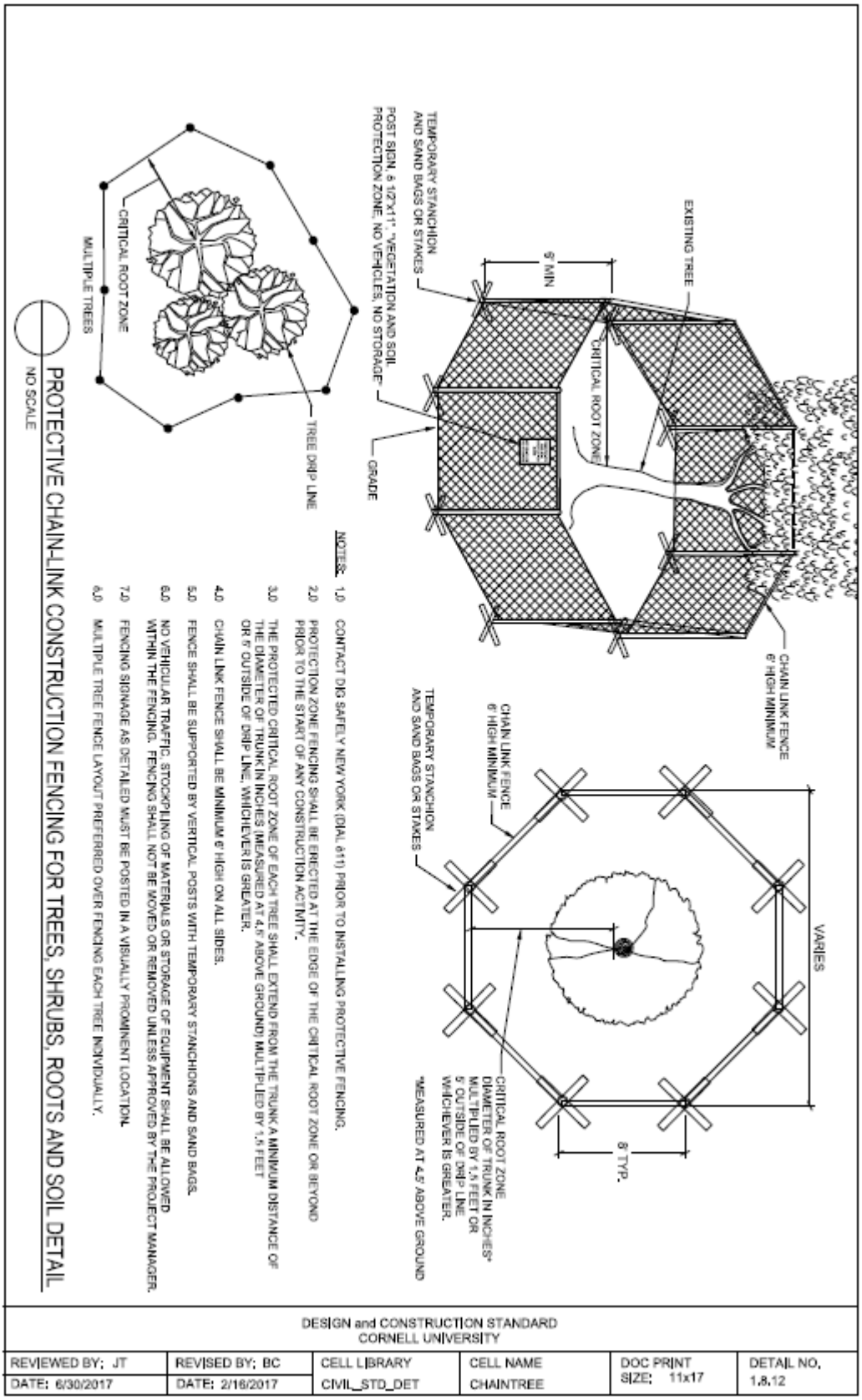
8.0 MULTIPLE TREE FENCE LAYOUT PREFERRED OVER FENCING EACH TREE INDIVIDUALLY.

NO SCALE

PROTECTIVE WOOD CONSTRUCTION FENCING FOR TREES, SHRUBS, ROOTS AND SOIL DETAIL

DESIGN and CONSTRUCTION STANDARD
CORNELL UNIVERSITY

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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

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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 in writing.

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. Field offices are not required.

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.

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 USE OF ELEVATOR

A. Use of Existing Elevator

1. If the Contractor elects to use the existing elevator equipment, the Contractor shall:

a. Provide adequate protection for such equipment and shall operate such equipment within a capacity not to exceed that allowed by law, rule or regulation.

b. Provide for the maintenance and cleaning of the elevator equipment as approved by the Owner's Representative.

c. Prior to start of construction, accurately record the condition of the existing elevator. Promptly repair or replace items that are damaged as a result of Contractor's use. Service calls that arise as a result of Contractor misuse will be charged to the Contractor. At Substantial Completion, restore elevators to condition existing before initial use.

d. Use only elevators designated by Owner's Representative at dates and times designated by Owner's Representative. Dates and times available for Contractor's use shall be scheduled with, and at the convenience of, the Owner, and may vary during the course of the Project.

e. Owner will not provide elevator operators or other monitoring of elevator use.

f. Do not load elevators beyond their rated weight capacity.

g. Provide code compliant protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator maintenance contractor to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

h. Procure and coordinate the elevator maintenance contractor to gain access to the elevator shaft as required to complete the Work

2.4 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.

2.5 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.

2.6 TEMPORARY SANITARY FACILITIES

A. The Owner shall designate sanitary facilities to be utilized by the Contractor during construction. The Contractor shall maintain neat, clean and sanitary conditions. The Contractor shall be responsible for costs associated with excessive custodial services associated with such usage.

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. The Contractor shall maintain existing or temporary building heating systems to accomplish the following:

1. Protect the existing facility and facility plumbing systems against damage due to cold temperatures.

2. Provide sufficient heat so that the Work can be accomplished in accordance with the Contract Documents.

3. Maintain construction schedules as required by the Contract.

B. Include in the bid price an amount necessary to provide Construction Heat as required.

C. Existing central steam systems may be used to the extent that they do not interfere with the safe and effective completion of Work. However, any modifications to existing systems shall be corrected prior to the conclusion of Work.

D. No natural gas is available to the facility for temporary heat.

E. At the conclusion of the project the facility heating systems shall be returned to functional order as necessary to protect the building and facility plumbing systems.

1.2 RESPONSIBILITY

A. The Contractor shall include in the bid the cost of the temporary heat.

B. The Contractor shall be responsible for repairs to the facility necessitated by the failure to provide heat during any portion of the Work.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 51 23*****

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 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.

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

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 "trouble-shooting".

   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.

C. Submit specified number of copies of approved data in final form prior to final acceptance.

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.

*****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. 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.

D. 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.

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 a 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 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.

B. 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 a part 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 VETERINARY MEDICAL CENTER LEVEL 1
FOR SURGE SPACE FOR VETERINARY RESEARCH TOWER

CORNELL UNIVERSITY
ITHACA, NEW YORK

SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. 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 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 017329 – Cutting, Patching and Repairing

D. Section 017400 - Construction Waste Management: Limitations on disposal of removed materials; requirements for recycling.

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 013000 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:

1. Areas for temporary construction and field offices.

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. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

1. Minimum of 5 years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 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. 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.
3. Provide, erect, and maintain temporary barriers and security devices.
4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
7. 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.
8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

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. Hazardous Materials:

1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

3.02 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.

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. Separate areas in which demolition is being conducted from areas that remain occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.

C. Remove existing work as indicated and required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
2. Remove items indicated on drawings.

D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.

1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. See Section 011000 - Summary for limitations on outages and required notifications.
4. Verify that abandoned services serve only abandoned facilities before removal.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. 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 024100

SECTION 033020 - CONCRETE SLABS ON GRADE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. ACI 302 "Guide for Concrete Floor and Slab Construction."

B. Provide protection from precipitation for vapor retarder and slab subbase prior to slab-on-grade placement. Provide curing and protection of concrete slabs in accordance with Section 3.15.

1.04 SPECIAL INSPECTIONS

A. Refer to Specification Section 014533 and Schedule of Special Inspections.

1.05 MATERIAL EVALUATION/QUALITY CONTROL

A. Contractor shall secure services of company field advisor from manufacturer of water vapor-reducing admixtures (WVRA) and concrete surface treatment products, including sealers, hardeners, sealants, and finishes. Field advisor shall be certified in writing by manufacturer to be technically qualified in product installation. Personnel involved solely in sales do not qualify. Field advisor shall be present at beginning of installation of product and as required during duration of project for the purpose of:

1. Render technical assistance to Contractor regarding installation procedures of product to satisfy warrantee or guarantee requirements.
2. Provide specialized training in use of product to Contractor's personnel.
3. Verify surface preparation procedures and suitable substrates for material application.
4. Verify proper mixing proportions and procedures for product.
5. Verify proper temperature and other environmental controls.
6. Verify proper tools and application procedures.
7. Verify proper curing and protection of installed product.
8. Familiarize Contractor/Owner/Architect/Engineer with entire system, including inspection techniques.
9. Answer questions that arise.

B. Field advisor shall prepare a written report summarizing information listed above. Submit report to Special Inspector, Contractor, Owner, Architect, and Engineer.

C. Contractor shall be responsible for expenses of field advisor and verifying credentials of advisor.

D. Contractor shall be responsible for the cost of any special procedures required by the manufacturer of WVRA to allow for the placement of slab finishes in advance of the specified minimum time period.

E. WVRA manufacturer's warranty shall include:

1. Term: Minimum of 10 years.
2. Repair and/or removal of failed flooring.
3. Placement of topical moisture remediation system.
4. Replacement of flooring materials equal to quality of original installation including material and labor.

1.06 SUBMITTALS

A. Comply with Section 033000.

B. Submit option for slab placement (see Part 3 of this section) and layout of slab joints.

C. Prior to slab placement, submit to Special Inspector and Engineer for information only, a written protection program for vapor retarder, slab subbase, slab on grade, and slab on metal deck.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT AND ACCESSORIES

A. Reinforcement: ASTM A 615, Grade 60 for uncoated deformed bars.

1. ASTM A 775 for epoxy-coated, deformed bars.
2. ASTM A 767 Class I for galvanized deformed bars.
3. ASTM A 955 for stainless steel deformed bars.
4. Coatings (epoxy or zinc) applied after fabrication and bending.

B. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized-steel wire into flat sheets.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. Supports for Reinforcement: Use wire bar-type supports complying with CRSI specifications. For slabs on grade, use chairs with sand plates or horizontal runners where base material will not support chair legs.

1. Concrete bricks may be used to support reinforcing for slabs on grade.
   a. Do not use clay bricks.
   b. Do not use bricks to support epoxy-coated or galvanized reinforcing.
   c. Do not use bricks to support reinforcing for slabs on metal deck.
2. Supports for epoxy-coated reinforcing shall be either wire bar-type coated with epoxy, plastic, or vinyl compatible with concrete for minimum distance of 2 inches from point of contact with reinforcing or all plastic-type.
3. Supports for galvanized reinforcing shall be either galvanized wire bar-type or all plastic-type.
4. Finish (epoxy-coated or galvanized) for supports formed from reinforcing bars shall match finish of supported reinforcing.

F. Minimum 16-gauge annealed tie wire, ASTM A 82.

G. Deformed-Steel Wire: ASTM A 496/A 496M.

H. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, plain steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

1. Provide coated wire ties for use with epoxy-coated or galvanized bars. Acceptable coatings include epoxy, nylon, or vinyl. Galvanized wire ties may be used with galvanized bars. Do not use plain wire ties.

2.02 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150. Type II or Type I/II only.

B. Fly Ash: ASTM C 618, Type F, with loss on ignition of less than 6 percent.

C. Ground-Granulated, Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Water: ASTM C 94, clean, fresh, drinkable.

E. Aggregates: NYSDOT-approved, Section 703-02 (normal weight), one source and as herein specified.

1. Fine Aggregate: Coarse, clean, sharp, uniformly graded natural sand free of loam, clay, lumps or other deleterious substances. Less than 10 percent passing No. 100 sieve and less than 3 percent passing No. 200 sieve.
2. Coarse Aggregate for Slabs on Grade: Uniformly graded to 1 1/2 inches, clean, processed, crushed stone with low absorption and free of flat/elongated particles. NYSDOT-approved, size 3A gravel can be used to meet large diameter requirement. Gradation similar to blended NYSDOT Type CA 2 and size 1A or ASTM C 33 Type 57 and Type 8, blended and modified as follows:

Sieve Size	Percent Passing
1 inch	95 to 98.5
3/4 inch	75 to 94
1/2 inch	25 to 50

3/8 inch	10 to 25
No. 4	0 to 10

2.03 ADMIXTURES

A. Air Entraining: ASTM C 260.

B. Set-Control Admixtures: Not permitted.

C. Calcium Chloride: Not permitted.

D. Water-Reducing Admixture: “Eucon WR-75” or “Eucon WR-91” by Euclid Chemical Co.; “MasterPozzolith 200” by Master Builders; or “Plastocrete 161” by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type A, and not contain more chloride ions than in municipal drinking water.

E. Mid to High Range Water Reducer/Finish Enhancer: “MasterPolyheed 997” by Master Builders; “Sikament 686” by Sika Chemical Corp; or accepted equivalent. Admixture shall conform to ASTM C 494 Type A and F and not contain more chloride ions than in municipal drinking water.

F. Integral Water Vapor-Reducing Admixture (WVRA): Sodium silicate admixtures by “Vapor Lock; “MVRA-CPS ADMIX” by Barrier One Concrete Admixtures; “MVRA 900” by ISE LOGIK; with the following minimum performance:

1. Water Vapor Transmission: Maximum 0.03 US perms per ASTM E 96.
2. Water Proofing: Maximum 1.0 x 10-8 cm/s per ASTM D-5084.

2.04 RELATED MATERIALS

A. Premolded Joint Filler for Slabs on Grade: Provide resilient and nonextruding, premolded, bituminous fiberboard units complying with ASTM D 1751; 1/2-inch-thick, full slab depth.

B. Construction Joint Form: Square edge form only. Keyed joint not permitted.

C. Semi-Rigid Epoxy Joint Filler for Interior Exposed Slabs: At exposed slabs, seal joints with “Sikadur 51SL” by Sika; “Sure Fil J52” by Dayton Superior; “MM-80P” by Metzger/McGuire; “Euco 700” by Euclid Chemical Co.

D. Semi-Rigid Polyurea Joint Filler for Interior Slabs: At interior slabs to receive broadloom carpet, hardwood, or VCT, seal joints with “Euco QWIKjoint 200” by Euclid Chemical Co.; “Spal-Pro RS 65” by Metzger/McGuire; “Sika Loadflex” by Sika; or accepted equivalent.

E. Cementitious Joint Filler for Interior Slabs (Self-Leveling Topping): At interior slabs to receive rubber-backed carpet, solid vinyl tile, and for all other floor coverings, seal joints with “Ardex K301” by Ardex; “Fast Setting Floor Resurfacer” by Quikrete; “Level-X52” by Edison Coatings; “SLT-HS” by Raeco; or accepted equivalent.

F. Polyurethane Joint Sealant for Exterior Slabs: “Sikaflex-2c SL” by Sika; “MasterSeal SL2” by Master Builders; “Eucolastic 2 SL” by Euclid Chemical Co.; “Urexpan NR-200” by Pecora Corporation; or accepted equivalent.

G. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces a square yard and complying with AASHTO M 182, Class 2.

H. Curing-Sheet Materials: ASTM C 171; waterproof paper, polyethylene film, or polyethylene-coated burlap.

1. For slabs exposed to view, provide one of the following or accepted equivalent:
   a. “HydraCure S16" by PNA Construction Technologies.
   b. “UltraCure NCF/SUN” by McTech Group.

I. Penetrating Exterior Anti-Spalling Sealer: “Euco-Guard 100” by Euclid Chemical Co. (mixed to 17.5 percent concentration); “MasterProtect H400” by Master Builders; “Aquapel Plus” by L&M Construction Chemicals; or accepted equivalent.

J. Evaporation Retarder: Monomolecular, film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss. “Aquafilm J74RTU” by Dayton Superior; “Eucobar” by Euclid Chemical Co.; “MasterKure ER 50” by Master Builders, Inc.; or accepted equivalent.

K. Crack Repair Material: For cracks smaller than 1/8 inch, use “Sika Pronto 19” methacrylate by Sika; “Rapid Refloor” polyurea by Metzger McGuire; or accepted equivalent. For cracks greater than 1/8 inch, use specified joint filler material.

L. Hardener: “MasterKure HD 300WB” by Master Builders, Inc.; or accepted equivalent for exposed slabs.

M. Vapor Retarder: Provide vapor retarder cover over prepared subbase where indicated below slabs on grade. Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154 as follows:

1. Polyolefin not less than 15 mils thick, in compliance with ASTM E 1745 Class A and with a perm rating less than 0.02 perms. “Stegowrap 15 mil Class A” by Stego Industries LLC; “Moistop Ultra 15" by Fortifiber Building Products; “Griffolyn 15 Mil Green” by Reef Industries, Inc.; or “Vapor Block 15” by Raven Industries.
2. Provide manufacturer’s-recommended, pressure-sensitive/water-resistant seam tape and mastic for vapor retarder selected.

N. Trowel Grade Topping: Polymer modified, cementitious, trowel-grade mortar with low shrinkage.

1. Shrinkage: Length change less than or equal to .03 percent for a 3”x3”x11 ¼” specimen. ASTM C-157.
2. May be installed to a depth of 1/4” minimum.
3. “SikaTop 122 Plus” by Sika, “Eucorepair V100”, by Euclid, “ MasterEmaco N 421 CI” , by Master Builders, or accepted equivalent.

2.05 PROPORTIONING AND MIX DESIGN

A. Concrete Quality:

Location	Required 28-Day Compressive Strength (psi)	Approximate Cementitious Materials Content (pounds)	Maximum Water/Cement Ratio	Percent Entrained Air
Interior slabs on grade	3,500	530	0.50 (265 pounds maximum total water)	2*

* Do not add air-entraining admixtures. Air entrapment occurs as result of mixing.

B. Slump: 5-inch maximum for normal and mid-range, water-reduced mixes.

C. Concrete containing a high-range, water-reducing admixture (superplasticizer) shall have maximum slump of 6 inches unless otherwise accepted by Engineer.

D. Use 564 pounds (6 sacks) maximum of cement for each cubic yard for interior slabs and minimum sand content.

E. For normal-weight concrete, quantity of coarse aggregate in pounds must be in range of 1.25 to 1.5 times quantity of fine aggregate in pounds. Provide minimum of 1,800 pounds of coarse aggregate for each cubic yard of concrete.

F. For lightweight concrete, provide minimum 675 pounds of lightweight coarse aggregate (saturated, surface dry) for each cubic yard of concrete.

G. Pozzolans:

1. Pozzolans may be substituted for cement in normal-weight concrete for interior slabs, including fly ash at a maximum rate of 20 percent by weight or ground-granulated, blast-furnace slag at a maximum rate of 35 percent by weight.
2. Pozzolans shall be used at a rate of 20 percent by weight of total cementitious materials for exterior slabs.
3. Submittals shall include actual mix design, including percentage of pozzolans and test results showing mix meets specified 7-day compressive strength where indicated, 28-day compressive strength, and air content.
4. Protect and heat concrete containing pozzolans during cold-weather conditions. Maintain protection and heat until 70 percent of specified design strength is achieved.

H. Pumping concrete is permitted only if mix designs specifically prepared and used previously for pumping are submitted. Mix designs not previously used for anticipated pump line lengths shall be tested by Contractor to verify suitability for project before use at site. Pump line shall have 5-inch-minimum inside diameter and be used with 5-inch pumps.

I. WVRA use:

1. Contractor has the option to use WVRA for interior slabs. Contractor shall coordinate with floor installer to provide appropriate floor adhesive for attachment to slabs containing WVRA, and shall review the proposed adhesive materials with the Architect. The optional use of WVRA and compatible floor adhesive shall not incur additional cost to the Owner.
2. Comply with Manufacturer's recommended dosage rates and procedures.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine conditions under which work shall be performed. Do not proceed with work until unsatisfactory conditions are corrected.

B. Whenever possible, air temperature should be rising after concrete placement. Attempt to schedule slab placements according to favorable weather reports.

3.02 OPTION FOR SLAB PLACEMENT

A. For placement of slabs that will be exposed in final structure, place construction and contraction joints as shown in drawings or as recommended by ACI 302 if not shown.

B. For placement of slabs that will be subsequently concealed with an architectural finish material, Contractor has two options. Option 1 is to place slabs with few joints or construction joints only. Option 2 is to place slabs with construction and contraction joint spacings as recommended by ACI 302, "Guide for Concrete Floor and Slab Construction." Contractor shall submit option to be used and joint layout to Architect and Engineer for review.

C. If Option 1 is selected, shrinkage cracking will likely occur but potential for curling will be reduced. Contractor shall be responsible for repairing cracks and curled areas. If Option 2 is selected, probability of shrinkage cracking will be less but probability of curling will increase. Contractor shall be responsible for repairing cracks and curled areas.

3.03 PRECONCRETE PLACEMENT

A. Just before concrete placement on grade, slab subbase shall be dry.

B. Whenever possible, air temperature should be rising after concrete placement. Attempt to schedule slab placements according to favorable weather reports.

C. Subgrade shall be frost-free.

3.04 EDGE FORMS AND SCREED STRIPS FOR SLABS ON GRADE

A. Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surfaces. Provide secure edge forms or screed strips to support strike-off templates or compacting vibrating-type screeds. Wet screeding is not permitted.

3.05 VAPOR RETARDER INSTALLATION

A. Following placement and compaction of subbase, place vapor retarder sheeting with longest dimension parallel with the direction of slab placement.

B. Install vapor retarder in accordance with ASTM E 1643, manufacturer's instructions, and as follows:

1. Lap joints 6 inches, and seal vapor retarder joints with manufacturer- recommended seam tape.
2. Extend vapor retarder up walls and penetrations 4 inches minimum.
3. Seal vapor retarder to walls and penetrations with manufacturer-recommended mastic to form continuous barrier.
4. Repair damaged areas by cutting patches of vapor retarder material and placing to overlap damaged areas by 6 inches each side. Seal each side of patch with seam tape.

C. Remove debris and standing water from vapor retarder prior to slab placement.

3.06 REINFORCEMENT PLACEMENT

A. Place slab reinforcing one-third of slab thickness below top surface of slabs on grade and 1 inch below top surface of slabs on metal deck. Support reinforcement by metal chairs, runners, bolsters, or concrete brick (slabs on grade only) as required. Stagger brick locations.

B. Dedicate workers to placement of reinforcement to continuously monitor and adjust reinforcement location during concrete placement.

C. Touch up damaged epoxy-coated reinforcement in field after placement with epoxy patching material provided by coating manufacturer.

3.07 INSTALLATION OF NON-STRUCTURAL EMBEDDED ITEMS

A. General: Notify other trades to permit installation of their work and coordinate with requirements of this section. Cooperate with other trades in setting work as required.

B. Do not embed aluminum items unless coated to prevent galvanic reaction with concrete and steel.

C. Do not embed conduit or other nonstructural items that are larger than the lesser of the following unless otherwise detailed:

1. One-inch diameter.
2. One-third the thickness of concrete slab above metal deck.

D. Avoid embedding conduit or other nonstructural items wherever possible. If unavoidable, limit size as noted above and install embedded item following the guidelines below.

1. Space at least 18 inches apart.
2. Place so nonstructural items do not cross each other.

3. Provide at least 1-inch concrete cover between items and slab surface. Provide minimum 3/4-inch concrete cover between items and deck, screed angles, edge forms, or reinforcing bars. Do not lay items on deck or reinforcing bars. In exterior slabs, provide at least 1½-inches concrete cover between items and exposed surfaces.
4. Provide at least 1-inch concrete cover between embedded items and shear connectors in composite beam construction.
5. Securely position items by wire tying to support chairs.

E. Items such as trench ducts and electrical floor boxes require special consideration. Known conditions are detailed in drawings. Notify Architect and Engineer of discrepancies or locations not detailed.

F. Install PVC sleeves at plumbing penetrations. Do not core-drill unless accepted by Engineer. Cut deck after slab has cured 28 days or after slab reaches its design strength.

3.08 ISOLATION JOINTS

A. Construct isolation joints in slabs at points of contact with vertical surface and elsewhere as indicated.

B. Use two layers of polyethylene film as bond breaker for slabs on metal deck.

3.09 CONSTRUCTION JOINTS

A. Locate and install construction joints not shown in drawings so as not to impair strength and appearance of structure as acceptable to Engineer.

B. Continue half of bar reinforcement through construction joints in concealed slabs and slabs on metal deck.

1. If Contractor chooses to cut reinforcement for slabs on grade after placement, protect the vapor retarder and use cutting method which will not result in damage to the vapor retarder. Thermal cutting of reinforcement after placement is not permitted.
2. Contractor shall repair damage to vapor retarder prior to slab on grade placement.

3.10 CONTRACTION JOINTS

A. Saw cut contraction joints as soon as possible after finishing, generally within 4 to 16 hours. Make sample cut to determine if concrete surface is firm enough so it is not torn or damaged by blade.

B. Use soft-cut contraction joints.

1. For slabs on grade, depth of cut shall be one-fifth of slab thickness with minimum of 1 inch.
2. For slabs on metal deck, depth of cut shall be one-fifth of slab cover over metal deck, with maximum depth of ¾ inch.

C. Obtain permission from Engineer if diamond blade cutting is to be used.

D. Continue half of bar reinforcement through contraction joints in concealed slabs and slabs on metal deck.

1. If Contractor chooses to cut reinforcement for slabs on grade after placement, protect the vapor retarder and use cutting method which will not result in damage to the vapor retarder. Thermal cutting of reinforcement after placement is not permitted.
2. Contractor shall repair damage to vapor retarder prior to slab placement.

3.11 PLACING CONCRETE SLABS

A. Maximum of 2 1/2 gallons for each cubic yard of total mix design water can be added in field. Water must be added prior to discharging and testing concrete. At no time shall total water exceed amount listed in accepted mix design.

B. Slabs on Grade:

1. Use strip pour methods and mechanical vibratory screed whenever possible.
2. Deposit and consolidate concrete in continuous operation within limits of construction joints until placing of panel or section is complete.
3. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
4. Maximum placement width shall not exceed 20 feet for very-flat and super-flat slabs.
5. Bring slab surfaces to correct level with a straightedge and strike off. Uniformly slope to drains. Use darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water or portland cement on plastic surface. Do not disturb slab surfaces before beginning finishing operations.
6. Maintain reinforcement in proper position during concrete placement operations. See requirements for reinforcement placement.
7. Slab thicknesses shown in drawings are minimum allowable. Maximum allowable thickness shall be 1 inch greater than specified thickness.
8. For floor areas with drains, Contractor shall be responsible for finishing concrete slabs to proper elevations to ensure surface moisture will drain freely to floor drains and no puddle areas exist. Reference elevations shown in drawings.
9. Cost of corrections to provide for positive drainage shall be the responsibility of Contractor.

3.12 SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerances for floor flatness (F_F) of 15 and floor levelness (F_L) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes to produce a profile amplitude of ¼ inch in one direction.

B. Float Finish: Apply power float finish to slab surfaces that will subsequently be trowel finished or covered with waterproofing membrane. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating using float blade or float shoes when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to overall tolerances of F_F 18 and F_L 13, and minimum local tolerances of F_F 13 and F_L 10. Cut down high spots and fill low spots. Uniformly slope surface to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin-film finish-coating system. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation. Surface shall be free of trowel marks, uniform in texture and appearance, and leveled to an overall tolerance of F_F 25 and F_L 20 and minimum local tolerance of F_F 17 and F_L 13 for carpet and ceramic or quarry tile finishes and overall tolerance of F_F 35 and F_L 25 and minimum local tolerance of F_F 25 and F_L 17 for exposed slabs and other finishes. Grind smooth surface defects that would telegraph through applied floor-covering system. Exposed surfaces are to be overtrowelled to "burn" surface to a dense, hard, dark finish.

1. Where test sample area includes multiple floor finishes, more stringent tolerances shall apply to entire test sample area.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified and immediately follow with fine brooming to slightly scarify surface.

E. Nonslip Broom Finish for Slabs on Grade: Apply nonslip, heavy broom finish to exterior concrete slab surfaces. Immediately after trowel finishing, roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Delay finishing as long as possible. Allow bleed water to evaporate before finishing.

G. Finish slabs to specified tolerances given. Patching low spots shall not be permitted. Perform grinding as soon as possible, preferably within 3 days, but not until concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

3.13 COLD-WEATHER CONCRETING

A. Comply with Section 033000.

B. Provide temporary heat with vented heaters only.

C. Use foggers to maintain humidity at 50 percent minimum.

3.14 HOT-WEATHER CONCRETING

A. Comply with Section 033000.

3.15 CURING AND PROTECTION

A. Protect freshly placed slabs from premature drying and excessive cold or hot temperature. Maintain without drying at a relatively constant temperature for time period necessary for cement hydration and proper hardening.

B. Cure exterior slabs completely by moist-curing using burlap absorptive cover, soaker hoses, and ponding for at least 7 days. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers. Avoid rapid drying at end of curing period. Allow absorptive cover to remain an additional 3 days.

C. Cure interior slabs by sheet-curing by covering slabs with curing sheet material for 7 days minimum. Avoiding rapid drying at end of curing period. Place curing cover in widest practicable width with sides and ends lapped at least 3 inches and sealed with waterproof tape or adhesive. Immediately repair holes or tears in cover during curing period.

D. Do not allow foot or other traffic over slabs during 7-day curing period.

E. Cure slabs or pads 14 days minimum before placing equipment.

F. Provide protection for concrete slabs from direct exposure to sun, wind, precipitation, and excessive cold or hot temperatures lasting from concrete placement until the building is enclosed and conditioned.

1. Protect the slab surface and slab openings from exposure to water; this includes water from construction activities and precipitation.
2. Contractor shall be responsible for cost of repairing slab defects and moisture issues resulting from deficient protection methods.
3. One method of protection is installing exterior walls, roof membrane and roof drains prior to installing vapor retarder, slab subbase, slab on grade, and slab on deck.

G. Interior Nonexposed Slabs:

1. Place finish toppings, coatings, tile, and other materials to be bonded to slabs when the following have been satisfied:
   a. Slabs have cured minimum of 90 days.
   b. Acceptable moisture vapor emission and alkalinity test results have been achieved.
   c. Acceptable 72-hour Bond Test results have been achieved. Bond test by floor finish installer.

H. Interior Exposed Slabs:

1. Apply two coats of hardener after slabs have cured 28 days minimum at rate of 100 square feet/gallon in accordance with manufacturer's recommendations.

I. Exterior Slabs:

1. Apply penetrating exterior anti-spalling sealer to exterior concrete slabs, walks, platforms, steps, ramps, and curbs according to manufacturer's directions.

3.16 JOINT SEALANT

A. Install joint sealant in exposed construction, isolation, and contraction joints in accordance with manufacturer's recommendations.

B. Clean joints thoroughly before applying sealant.

C. Apply sealant after slabs have cured 90 days minimum.

3.17 REPAIR OF SURFACES

A. Contractor shall be responsible for cost of repairing slab defects.

B. Test surfaces for flatness and level tolerances. Test uniform surfaces sloped to drain for trueness of slope.

C. Correct flatness and levelness defects by grinding or removing and replacing slab. Patching low spots not permitted. Repair areas shall be remeasured and accepted by Owner.

D. Repair cracks only when slab is more than 90 days old. Use crack repair material. For cracks over 1/8 inch, fill crack with oven-dried sand prior to application of crack repair material as recommended by manufacturer. Contractor has option to remove and rebuild areas of cracking. Mask cracks to limit crack repair material to crack only.

E. Repair curling only when slab is more than 90 days old.

F. Curling at slab edges exceeding 1/8 inch when measured with a 10-foot straightedge shall be made level by grinding or planing. Locate straightedge with its end at the slab edge, and measure space between straightedge and slab.

G. If curling exceeds 1/4 inch, level slab by grinding or planing as stated above. In addition, core-drill slab 10 inches from joint at 2 foot intervals, alternating on each side of joint, and inject nonshrink grout to fill void beneath slab.

H. Repair edge spalls occurring from shrinkage cracking or from Contractor's operations with methods acceptable to Engineer.

END OF SECTION 033020

SECTION 035400 - CAST UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.

1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Manufacturer's Instructions.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number, and shelf life.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.06 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

C. Do not mix with cement or additives other than underlayment manufacturer's approved products

D. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.

1. Manufacturers:
   a. ARDEX Engineered Cements; ARDEX K 34 LIGHTWEIGHT with ARDEX P51 Primer: www.ardexamericas.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Cast Underlayments, General:

1. Comply with applicable code for combustibility or flame spread requirements.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:

1. Compressive Strength: Minimum 4000 pounds per square inch after 28 days, tested per ASTM C109/C109M.
2. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
3. Density: 125 pounds per cubic foot, nominal.
4. Final Set Time: 1-1/2 to 2 hours, maximum.
5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Cement Binder: ASTM C150/C150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.

D. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

E. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

F. Reinforcement: Galvanized metal lath complying with recommendations of underlayment manufacturer for specific project circumstances.

G. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

H. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.VOC Content:

1. Provide coating with VOC content of 100 g/L or less.

I. Joint and Crack Filler: Latex-based filler, as recommended by manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

1. When installing over adhesive residues on concrete, the adhesive must first be tested to make certain it is non-water-soluble.
2. Water-soluble adhesives must be completely mechanically removed down to clean concrete.
3. Non-water-soluble adhesive should be prepared to a thin, well-bonded residue using the wet scraping technique as recommended by the Resilient Floor Covering Institute (www.rfci.com).
4. The prepared residue should appear as nothing more than a transparent stain on the concrete after scraping.
5. Moisture Testing: Perform tests as required by manufacturer, but no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours or as recommended by hydraulic cement underlayment manufacturer.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.

C. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

D. Vacuum clean surfaces.

E. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

F. Close floor openings.

3.03 APPLICATION

A. Mix and install underlayment in accordance with manufacturer's written instructions.

1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.

B. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

C. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

D. Install underlayment to produce uniform, level surface.

E. Install a final layer without aggregate to product surface.

F. Feather edges to match adjacent floor elevations.

G. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

H. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Cure underlayment in accordance with manufacturer's instructions.

C. Prevent contamination during installation and curing processes.

3.05 INSTALLATION TOLERANCES

A. Finish and measure surface, so gap at any point between gypsum cement underlayment surface and an unleveled, freestanding, 10-foot-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

3.06 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Protect underlayment from concentrated and rolling loads for remainder of construction period.

C. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 035400

SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Concrete block.
2. Clay facing brick.
3. Mortar and grout.
4. Reinforcement and anchorage.
5. Flashings.
6. Lintels.
7. Accessories.

B. All work included in this section is applicable to Add Alternate #1.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Loose steel lintels.

B. Section 072100 - Thermal Insulation: Insulation for cavity spaces.

C. Section 072700 - Air Barriers: Air / Vapor-resistive barriers applied to exterior face of unit masonry substrate.

D. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

F. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.

G. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.

H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

K. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.

L. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

M. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

N. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

O. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2023.

P. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

Q. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 SUBMITTALS

A. Product Data: Contractor shall provide product data sheets for each type of material specified in the mortar mix design. The product data shall include test data substantiating that proposed products comply with specifications. The aggregate source for sands shall be tested and pass as per ASTM C295 Petrographic Examination of Aggregates for Concrete to determine if ASR is present, on a biennial basis.

B. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

C. Samples:

1. Submit four samples of facing brick units to illustrate color, texture, and extremes of color range. Bricks shall be color matched to existing units for seamless integration.
2. Mix Design Samples: Contractor shall provide each type of pointing mortar in the form of sample mortar strips, 6 inches long by ½ inch wide, set in aluminum or plastic channels.

D. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

E. Mockup: Upon approval of Mix Design Samples, Contractor shall provide an in-situ mockup for final approval of the mortar installation. Contractor shall provide a minimum of three (3) mortar samples in designated areas for consideration by the Design Professional and the Owner for final selection of project mortar composition, color, joint profile, and texture. Mortar samples may vary in sand composition and cement color but must comply with the overall mortar specification.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of 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 of documented experience.

D. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

E. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

F. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

G. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.

B. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

E. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: ASTM C 90, normal weight unless indicated otherwise manufactured to dimensions 3/8 inch less than nominal dimensions.

1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.

1. Color and texture: To match existing for seamless integration into exterior wall.
2. Nominal size: To match existing for seamless integration into exterior wall .
3. Coordinate with Cornell Project Manager on availability of archived brick veneer product data.

2.03 MORTAR AND GROUT MATERIALS

A. Contractor to provide laboratory chemical analysis & testing for mortar mix matching to determine existing sand color proportions, sand gradations, & mortar mix proportions. Provide mortar to mix to match existing based on results of testing.

B. Alkali Aggregate Reaction (AAR): Local aggregates have the potential for AAR.

1. Alkali-Silica Reaction (ASR):
   a. ASR is the most common form of alkali-aggregate reaction (AAR) in concrete; the other, much less common form, is alkali-carbonate reaction (ACR). ASR and ACR are therefore both subsets of AAR. ASR is caused by a reaction between the hydroxyl ions in the alkaline cement pore solution in the concrete and reactive forms of silica in the aggregate. A gel is produced, which increases in volume by taking up water and so exerts an expansive pressure, resulting in failure of the mortar.

2. Alkali-silica reactivity (ASR) Evaluation: (ASTM C-33, Appendix X1.2.1.3)
   a. Certain materials are known to be potentially deleteriously alkali-silica reactive (Reference ASTM C-33). Determination of the presence and quantities of these materials by petrographic examination is helpful in evaluating potential alkali reactivity.

3. Related Specifications and Information Sources:
   a. ASTM C33: Standard Guide for Concrete Aggregates
      1) Appendix X1: Methods for Evaluating Potential for Deleterious Expansion due to Alkali Reactivity of Aggregate.
      2) ASTM C295: Standard Guide for Petrographic Examination of Aggregates for Concrete.

3) New York State Department of Transportation: (NYSDOT) Aggregate Source Acceptance Procedure.
4) NYSDOT – Technical Services – Materials – Approved List; Sources of Fine and Coarse Aggregates.

C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

1. Color(s): To match existing when incorporated into specified mix design(s).
2. Manufacturers:
   a. Davis Colors, a division of Venator Materials PLC; True Tone Mortar Colors: www.daviscolors.com/#sle.
   b. Solomon Colors, Inc; SGS Mortar Colors: www.solomoncolors.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.

D. Water: Clean and potable.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; galvanized.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Ladder.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.

1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 3-1/2 inches.
4. Contractor shall not use corrugated masonry wall ties (Hohmann & Barnard CWT - Corrugated Wall Tie and similar) on exterior applications

2.05 FLASHINGS

A. Metal Flashing Materials:

B. Combination Non-Asphaltic Flashing Materials - Stainless Steel:

1. Stainless Steel Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner.

C. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.

D. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

E. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage. Provide mortar net full-height and full-width of all masonry cavity walls.

D. Weeps:

1. Type: Hohmann & Barnard QV Quadro-vent or similar.
2. Color(s): As selected by Architect from manufacturer's full range.
3. Contractor shall provide vents at the base and top of all masonry cavity walls.

2.07 LINTELS

A. Galvanized Prefabricated Steel Lintels: See structural drawings.

B. Brickwork Support System: Offset steel relief angles or lintels with hanger brackets for support of brickwork above horizontal masonry joints and openings to allow insulation to span continuously behind brick and eliminate continuous thermal bridges associated with support systems that interrupt continuous insulation.

2.08 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

1. Exterior, loadbearing masonry: Type N.
2. Exterior, non-loadbearing masonry: Type N.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar to portland cement and lime.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Do not use units cut to less than one-half size.

E. Do not install concrete masonry units with more than 5 percent damage to the face.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.05 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

D. Brick Units:

1. Bond: Running.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.06 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

3.07 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.08 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

3.09 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.10 LINTELS

A. Install loose steel lintels over openings.

B. Maintain minimum 8 inch bearing on each side of opening.

C. Install thermal brick support system in accordance with manufacturer's instructions at locations indicated on drawings

3.11 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.12 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.13 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, around penetrations and where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

E. Replace defective mortar. Match adjacent work.

F. Clean soiled surfaces with cleaning solution.

3.15 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042000

SECTION 061053 – MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Fire retardant treated wood materials.

C. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.

C. PS 1 - Structural Plywood; 2023.

D. PS 20 - American Softwood Lumber Standard; 2021.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.04 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 WOOD PRODUCTS, 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.

2.02 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1, A-D plywood; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.03 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.

2.04 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.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

2. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   a. Treatment shall not promote corrosion of metal fasteners.
   b. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   c. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   d. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.
3. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
4. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
5. Application: Treat items indicated on Drawings, and the following:
   a. Concealed blocking.
   b. Plywood backing panels.

C. Preservative Treatment:

1. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
   b. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
2. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 18 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
4. Application: Treat items indicated on Drawings, and the following:
   a. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Select material sizes to minimize waste.

D. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

E. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.03 PROTECTION

A. Protect rough carpentry from weather.

END OF SECTION 061053

SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

1.02 RELATED REQUIREMENTS

A. Section 123600 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

B. Product Data: Provide data for hardware accessories.

C. Samples:

1. Submit samples of each type of plastic laminate indicating finish, color, and texture. Minimum 6x12 inches.
2. Samples: Submit samples of each type of edge banding, minimum 12” long.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide designated labels on installed products as required by certification program.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:

1. Finish - Exposed Exterior Surfaces: Decorative laminate.
2. Finish - Exposed Interior Surfaces: Decorative laminate.
3. Finish - Semi-Exposed Surfaces: Decorative laminate
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
6. Door and Drawer Front Retention Profiles: Fixed panel.
7. Casework Construction Type: Type A - Frameless.
8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
9. Cabinet Design Series: As indicated on drawings.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Side Construction: Multiple-dovetailed.
13. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 PANEL CORE MATERIALS

A. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

1. Grade: 130; moisture resistance: MR30.
2. Panel Thickness: 3/4 inch unless noted otherwise on drawings.

2.04 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

B. Provide specific types as follows:

1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as indicated, finish as indicated.
2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as indicated, finish as indicated.
3. Cabinet Liner: CLS, 0.020 inch nominal thickness, colors as indicated, finish as indicated.
4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.05 COUNTERTOPS

A. Countertops: See Section 123600.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

C. Fasteners: Size and type to suit application.

D. 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.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.07 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Shelf Support Brackets: Fixed, L-shaped, corner reinforced, face-of-stud mounting.

1. Materials: Formed steel shapes.
   a. Finish: Manufacturer's standard, factory-applied, powder coat.
   b. Color: Black.

D. Drawer and Door Pulls: "U" shaped wire pull, stainless steel with 6 inch centers.

E. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

F. Cabinet Catches and Latches:

1. Type: Magnetic catch.

G. Drawer Slides:

1. Type: Full extension type with overtravel.
2. Static Load Capacity: Heavy-duty grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.

H. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

2.08 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL (DIR) listed and approved identification on fire retardant treated material.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 064100

SECTION 070553 - FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code.

B. BCNYS (BC) – Building Code of New York State

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

D. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC) and BCNYS (BC).

B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.

C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 099123 for products.

D. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.01 PREPARATION

A. See Section 099123 for substrate preparation for painted markings.

3.02 INSTALLATION

A. Locate markings as required by ICC (IBC) and BCNYS (BC).

B. Install adhered markings in accordance with manufacturer's instructions.

C. Install applied markings in accordance with Section 099123.

D. Install neatly, with horizontal edges level.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION 070553

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. SECTION INCLUDES

1. Board insulation at cavity wall construction.

B. Work included in this section is applicable to Add Alternate #1.

C. RELATED REQUIREMENTS

1. Section 072700 - Air Barriers: Separate air barrier materials.

1.02 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) 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. Basis-of-Design: DuPont Styrofoam Brand Ultra SL XPS, 2.18 inch thickness.

1. Type and Compressive Resistance: Type IV, 25 psi, minimum.
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. Thermal Resistance, R-value: 5.6 minimum, per 1 inch thickness at 75 degrees F mean temperature.

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 honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 072100

SECTION 072700 - AIR BARRIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air barriers.

B. Work included in this section is applicable to Add Alternate #1.

1.2 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Air barrier under exterior cladding.

1.3 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.4 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2016 (Reapproved 2021).

B. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

G. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.6 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

B. Air Barrier Association of America (ABAA) Evaluated Air Barrier Assemblies; www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

D. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.7 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 - PRODUCTS

2.1 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR IMPERMEABLE)

A. Air and Vapor Barrier Sheet, Self-Adhered:
1. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 0.1 perms (5.72 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method.

3. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
6. Complies with NFPA 285 requirements for wall assembly.
7. Seam and Perimeter Tape: As recommended by sheet manufacturer.
8. Products:
    a. Carlisle Coatings and Waterproofing, Inc; Fire Resist 705FR-A: www.carlisleccw.com/#sle.
    b. Carlisle Coatings and Waterproofing, Inc; Fire Resist 705 FR-A XLT (Xtra Low Temperature): www.carlisleccw.com/#sle.
    c. GCP Applied Technologies; Perm-A-Barrier NPS: www.gcpat.com/#sle.
    d. Tremco Commercial Sealants & Waterproofing; ExoAir 110: www.tremcosealants.com/#sle.
    e. Substitutions: See Section 016000 - Product Requirements.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
2. Color: Green.
3. Elongation: 1,300 percent, measured in accordance with ASTM D412.
4. Peel Adhesion: 28 lb/inch (5.0 kg/cm), minimum, when tested in accordance with ASTM D903.
5. Hydrostatic Head Pressure: Resists head pressure of 57 feet (17.4 m), maximum, when tested in accordance with ASTM D751.
6. Comply with NFPA 285 requirements for wall assembly.
7. Products:
    a. Karnak Corporation; 323 K-NRG Gap Seal FR: www.karnakcorp.com/#sle.
    b. Rubber Polymer Company; Rub-R-Wall Mastic: www.rpcinfo.com/#sle.
    c. TYPAR; TYPAR HD Heavy-Duty Sealant: www.typar.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Self-Adhered Sheets:
1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle fashion to shed water and seal laps airtight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer, to seal to adjacent substrates, and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

E. Openings and Penetrations in Exterior Air Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
4. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify ABAA in writing of schedule for air barrier work and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed air barriers until required inspections have been completed.

D. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of installation prior to covering up air barriers.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072700

SECTION 078400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

UL Fire Resistance Directory:

a Firestop Devices (XHJI)
b Fire Resistance Ratings (BXRH)
c Through-Penetration Firestop Systems (XHEZ)
d Fill, Voids, or Cavity Material (XHHW)
e Forming Materials (XHKU)
f Joint Systems (XHBN)
g Perimeter Fire Containment Systems (XHDG)

Alternate Systems: “Omega Point Laboratories Directory” (updated annually).

E. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

J. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 GENERAL DESCRIPTION OF WORK

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
2. Safing slot gaps between edge of floor slabs and curtain walls.
3. Openings between structurally separate sections of wall or floors.
4. Gaps between the top of walls and ceilings or roof assemblies.
5. Expansion joints in walls and floors.
6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
7. Openings around structural members which penetrate floors or walls.

1.05 DESIGN REQUIREMENTS

A. Devices and materials shall meet the hourly fire resistance ratings required by the Project as determined by UL 263, UL 1479, UL 2079, ASTM E119 or ASTM E814 and be listed and detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.

1. Exception: For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Submittals Package: Submit the following items specified below at the same time as a complete package:

1. Product Data.
2. Installation Instructions.
3. Quality Control Submittals.
4. Firestop Schedule.

C. Product Data: Catalog sheets, specifications and installation instructions for each firestop device and material. Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Quality Control Submittals:

1. Design Data: Show details and include engineering information and manufacturer’s written recommendations required under Design Requirements Article for each proposed firestop if other than a design detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.

a. State the specific locations where each firestop is proposed to be installed.

2. Installer's Qualifications Data:

a. Name of each person who will be performing the Work and their employer's name, business address and telephone number.
b. Names and addresses of 3 similar projects that each person has worked on during the past 5 years.

3. Company Field Advisor Data:
a. Name, business address and telephone number of Company Field Advisor secured for the required services.
b. Certified statement from the Company listing the qualifications of the Company Field Advisor, and listing of services and each product specifically listed for this Project for which Company Field Advisor is given authorization by the Company to render advice.

F. Firestop Schedule: Submit schedule itemizing the following:

1. Manufacturer's product reference numbers and/or drawing numbers.
2. UL, Inchcape Testing Services, Factory Mutual Research Corp., or Omega Point Lab design number.
3. Location of firestop material.
4. Penetrating Item Description/Limits: Material, size, insulated or uninsulated, and combustibility.
5. Maximum allowable annular space or maximum size opening.
6. Wall type construction.
7. Floor type construction.
8. Hourly Fire resistance rating of wall or floor.
9. F rating.
10. T rating, if available.

NOTE: Firestop Schedule is for information only and will not be acted on for approval. Refer to Sample Firestop Schedule bound in Appendix.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installation Responsibility: General Contractor shall assign installation of through-penetration firestop systems and fire-resistive joint systems in the Project to a single sole source firestop specialty contractor.
2. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
3. The work is to be installed by a contractor with at least one of the following qualifications:
a. FM 4991 Approved Contractor
b. UL Approved Contractor
c. Hilti Accredited Fire Stop Specialty Contractor

4. The installer must have no less than 3 years of experience with fire stop installation.

B. Container/Package Labels: Include manufacturer's name and identifying product number, date of manufacturer, lot number, shelf life (if applicable), qualified testing and inspecting agency classification marking, curing time, and mixing instructions for multi-component materials.

C. Company Field Advisor: Secure the services of a Company Field Advisor for the following:
   1. Render advice regarding suitability of firestopping materials and methods.
   2. Assist in completing firestop schedule.

D. Field-Constructed Sample Installations: Prior to installing firestopping, erect sample installations for each type through-penetration firestop system indicated in the Firestop Schedule to verify selections made and to establish standard of quality and performance by which the firestopping work will be judged.
   1. Build sample installations to comply with the following requirements, using materials indicated for final installations.
      a. Locate sample installations on site at locations where directed.
      b. Obtain Owner's acceptance of sample installations before start of firestopping installation.
      c. Retain and maintain sample installations during construction in an undisturbed condition.
      d. Accepted sample installations in an undisturbed condition at time of substantial completion of Project may become part of completed firestopping work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping materials to the Site in original, new unopened containers or packages bearing manufacturer's printed labels.

B. Store and handle firestopping materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, etc.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Temperature: Do not install firestopping materials when ambient or substrate temperatures are outside limits permitted by manufacturer of firestopping materials.
   2. Humidity and Moisture: Do not install the Work of this Section under conditions that are detrimental to the application, curing, and performance of the materials.
   3. Ventilation: Provide sufficient ventilation wherever firestopping materials are installed in enclosed spaces. Follow manufacturer's recommendations.

1.08 SEQUENCING AND SCHEDULING

A. Leave exposed those firestopping installations that are to be concealed behind other construction until the Owner's Representative has examined each installation.

PART 2 PRODUCTS

2.01 FIRESTOPPING-GENERAL

A. Through-Penetration Firestop Devices, Forming Materials, And Fill, Void or Cavity Materials: As listed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.
    1. For firestopping exposed to moisture, furnish products that do not deteriorate when exposed to this condition.
    2. For firestopping systems exposed to view, furnish products with flame-spread values of less than 25 and smoke developed values less than 50, as determined per ASTM E84.
    3. For penetrations for piping services below ambient temperature, furnish moisture-resistant through-penetration firestop systems.
    4. For penetrations involving insulated piping, furnish through-penetration firestop systems not requiring removal of insulation.

B. Accessories: Components required to install fill materials as recommended by the firestopping manufacturer for particular approved fire rated system.

C. Identification Labels:
    1. Furnished by fire stopping manufacturer of suitable material for permanent field identification of through-penetration firestops.
    2. Identify the following:
        a. “WARNING - FIRESTOP MATERIAL”.
        b. Company Name.
        c. Product Catalog number.
        d. F rating.
        e. T rating, if available.
    3. Field fabricated labels are not acceptable.

2.02 MANUFACTURERS

A. Firestopping Manufacturers:
    1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
    2. Hilti, Inc: www.hilti.com/#sle.
    3. RectorSeal, a CSW Industrials Company; Metacaulk 150+ General Purpose Firestop Sealant: www.rectorseal.com/firestop-solutions/#sle.
    4. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
    5. Substitutions: See Section 016000 - Product Requirements.

2.03 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine existing through-penetrations of floors, walls, partitions, ceilings and roofs in the Work areas.

B. Examine existing junctures, control joints, and expansion joints in the Work areas.

C. Where firestopping is missing or not intact, submit a written report to the Director's Representative describing the existing conditions.

3.02 PREPARATION

A. Clean out openings immediately before installation of through-penetration firestopping. Comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove foreign materials from surfaces of openings, and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Clean out openings, and juncture, control, and expansion joints immediately before installation of firestopping. Comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove foreign materials from surfaces of openings and joint substrates, and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening joint substrates to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

C. Protection:
   1. Protect surfaces adjacent to through-penetration firestops with non-staining removable masking tape or other suitable covering to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or that would be caused by cleaning methods used to remove smears from firestopping materials.

D. Substrate Priming:
   1. Prime substrates in accordance with the firestopping manufacturer's printed installation instructions using recommended products and methods.
   2. Do not allow primer to spill or migrate onto adjoining exposed surfaces.

3.03 INSTALLATION OF THROUGH PENETRATION FIRESTOPS

A. Use through-penetration firestop devices, forming materials, and fill, void or cavity materials to form through-penetration firestops to prevent the passage of flame, and limit temperature

rise of the unexposed surface as detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide, or the Omega Point Laboratories Listings Directory.

1. Where applicable design is not detailed in the Directories, use forming materials and fill, void or cavity material to form through-penetration firestop in accordance with approved printed details and installation instructions from the company producing the forming materials and fill, void or cavity material.
2. If the construction type(s) of the building cannot be determined, provide firestopping with fire resistance ratings as specified in the Building Code of New York State, Tables 720.1(1), 720.1(2), 720.1(3), and 302.3.2.

B. Provide through-penetration firestop systems with F ratings that shall equal or exceed the fire resistance rating of the penetrated building construction.

C. Provide through-penetration firestop systems with T ratings, in addition to F ratings, at floors where the following conditions exist:
   1. Where firestop systems protect penetrations located outside the wall cavities.
   2. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
   3. Through-penetration firestop systems protecting floor penetrations require a T-rating of at least 1 hour, but not less than the required floor fire-resistance rating.

D. Firestop through-penetrations of floors, walls, partitions, ceilings, and roofs.

E. Firestop through-penetration of partitions identified on the Construction Work Drawings as smoke partitions and fire rated assemblies.

F. Firestop through-penetrations of floors, walls, partitions, ceilings, and roofs in accordance with the fire resistance rating assigned to the walls, partitions, floors, ceilings, and roofs on the Construction Work Drawings.

G. In areas where through-penetration items have been installed before the construction work, firestop the through-penetration items after the construction work has been completed. Furnish drawings or written information to the Construction Work Contractor covering the provisions to be made in the construction work to enable firestopping of the through-penetration items.

H. Permanently affix label at each firestop. Use adhesive compatible with surface construction at firestop location.

3.04 INSTALLATION OF JUNCTION, CONTROL, AND EXPANSION JOINT FIRESTOPS

A. Use joint treatment materials to form firestop to prevent the passage of flame and limit temperature rise of the unexposed surface, as detailed in the UL Fire Resistance Directory, Inchcape Directory of Listed Products, Factory Mutual Approval Guide or the Omega Point Laboratories Listings Directory.
   1. Where applicable design is not detailed in the Directories, use forming materials and fill, void or cavity material to form firestop in accordance with approved printed details and installation instructions from the company producing the forming materials and fill, void or cavity material.
   2. If the construction type(s) of the building cannot be determined, provide firestopping with fire resistance ratings as specified in the Building Code of New York State, Tables 720.1(1), 720.1(2), 720.1(3), and 302.3.2.

B. Firestop junctures, control joints, and expansion joints.

C. Firestop junctures, control joints, and expansion joints associated with smoke partitions and fire rated construction.

D. Permanently affix labels every 10 feet (304.8 cm) along each firestop. Use adhesive compatible with surface construction at firestop location.

3.05 IDENTIFICATION & DOCUMENTATION

A. The firestop contractor is to supply documentation for each single application addressed.

B. The Documentation Form for through penetrations is to include:
1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed Description of the Penetration's Location
5. Tested System or Engineered Judgment Number
6. Type of Assembly Penetrated
7. A Detailed Description of the Size and Type of Penetrating Item
8. Size of Opening
9. Number of Sides of Assemblies Addressed
10. Hourly Rating to be Achieved
11. Installer's Name

C. The Documentation Form for Construction Joints is to include:
1. A Sequential Location Number
2. The Project Name
3. Date of Installation
4. Detailed Description of the Construction Joint's Location
5. Tested System or Engineered Judgment Number
6. Type of Construction Joint
7. The Width of the Joint
8. The Lineal Footage of the Joint
9. Number of Sides Addressed
10. Hourly Rating to be Achieved
11. Installer's Name

D. Copies of these documents are to be provided to the general contractor at the completion of the project.

3.06 CLEANING

A. Clean off excess fill materials and sealants adjacent to penetrations by methods and cleaning materials recommended by manufacturers of firestopping products and of products in which penetrations occur.

B. Remove masking tape as soon as practical so as not to disturb the firestopping's bond with substrate.

C. Protect firestopping during and after curing period from contact with contaminating substances, or damage resulting from adjacent Work.

D. Cut out and remove damaged or deteriorated firestopping immediately and install new materials as specified in firestop schedule.

3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS

A. If firestopping is not assigned to a single-source firestop specialty contractor, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

END OF SECTION 078400

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Nonstaining silicone joint sealants.

B. Mildew-resistant joint sealants.

C. Butyl joint sealants.

D. Latex joint sealants.

1.02 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

C. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product.

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. Backing material recommended by sealant manufacturer.
4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
5. Substrates the product should not be used on.
6. Substrates for which use of primer is required.
7. Including manufacturer’s installation instructions.

B. Quality Control Submittals:

1. Installer’s Qualifications Data: Affadavit required under Quality Assurance Article
2. Company Field Advisor Data: Name, Business Address and Telephone Number of Company Field Advisor

C. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.

2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

E. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. The persons installing the sealants and their supervisor shall be personally experienced in the installation of sealants and shall have been regularly employed by a company engaged in the installation of sealants for a minimum of two years.

a. Furnish the names and addresses of five similar projects which the foregoing people have worked on during the past two years.
b. Furnish a letter from the sealant manufacturer, stating that the foregoing people are authorized to install the manufacturer's sealant materials and that the manufacturer's specifications are applicable to the requirements of this Project.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
2. Test and validate sealants used for exterior weathersealing per the Sealant Waterproofing Restoration Institute (SWRI).

C. Container Labels: Include manufacturer's name, trade name of product, kind of material, federal specification number (if applicable), expiration date (if applicable), and packaging date or batch number.

D. Installation Plan: Include schedule of sealed joints, including the following:

1. Joint width indicated in Contract Documents.
2. Installation Log Form: Include the following data fields, with known information filled out.

a. Location on project.
b. Substrates.
c. Sealant used.
d. Date of installation.
e. Name of installer.
f. Actual joint width; provide space to indicate maximum and minimum width.
g. Actual joint depth to face of backing material at centerline of joint.
h. Air temperature.

E. Do not proceed with installation of joint sealants under the following conditions:

1. Humidity and Moisture: Do not install the Work of this Section under conditions that are detrimental to the application, curing and performance of the material.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
3. When joint substrates are wet.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
6. Ventilation: Provide sufficient ventilation wherever sealants, primers, and other similar materials are installed in enclosed spaces. Follow manufacturer's recommendations.

1.05 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

D. Product Warranties

1. Silicone Sealant: 20 years weatherseal warranty.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS - GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

C. Colors of Concealed Joint Sealants: provide the natural color which has the best overall performance characteristics.

D. Do Not Seal:

1. Intentional weep holes in masonry.
2. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.

2.02 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

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. Pecora Corporation; 890FTS.
b. Pecora Corporation; 890NST.
c. Or equal.

2.03 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Neutral Curing, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

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. Pecora Corporation; 898NST Sanitary Silicone
b. Or equal.

2.04 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

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. Pecora Corporation; BC-158.
b. PTI; 707.
c. Tremco; Butyl Sealant.
d. Or equal.

2.05 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide the following:

a. Bostik; Duo-Sil.
b. GE Construction Sealants; All Weather Pro Sealant.
c. Pecora Corporation; AVW-920; AC-20.
d. Or equal.

B. Pre-formed Sealant: Preformed paintable sealant strips of open cell, compressible urethane foam, saturated with non-drying, non-staining, and non-migrating butylene compound.

2.06 JOINT FILLERS

A. Closed Cell Neoprene Joint Filler: ASTM D 1056, Class SC (oil resistant and medium swell), 2 to 5 psi compression deflection.

B. Closed Cell Polyurethane Joint Filler: Resilient, compressible, semi-rigid; W.R. Meadows Ceramar or A.C. Horn Closed Cell Plastic Foam Filler, Code 5401.

2.07 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) or as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.

C. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.02 INSTALLATION

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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind 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 sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. 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 in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

H. 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.03 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical and horizontal nontraffic surfaces, Type 1.

1. Joint Locations:

    a. Control and expansion joints in unit masonry and brick veneer.
    b. Perimeter joints between materials listed above and frames of doors, windows, and storefront assemblies.
    c. Other joints as indicated on Drawings.

2. Joint Sealant:

    a. Silicone, S, NS, 100/50, NT

B. Joint-Sealant Application: Exterior joints in horizontal or vertical traffic surfaces, Type 2.

1. Joint Locations:

    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. Other joints as indicated on Drawings.

2. Joint Sealant:

    a. Silicone, S, NS, 100/50, T, NT

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces, non-security.

1. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints.
    c. Other joints as indicated on Drawings.

2. Joint Sealant:

    a. Silicone, Mildew Resistant, Neutral Curing, S, NS, 50, NT

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    c. Joints and cracks 3/16” or less in width.
    d. Other joints as indicated on Drawings.

2. Joint Sealant:

    a. Acrylic latex

E. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.

END OF SECTION 079200

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. Hollow metal borrowed lites glazing frames.

E. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Interior Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

E. 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.

F. 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.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

J. ITS (DIR) - Directory of Listed Products; Current Edition.

K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

M. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: 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 UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

E. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified/#sle.

F. 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. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

D. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

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. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Edge Profile: Manufacturers standard for application indicated.
4. Typical Door Face Sheets: Flush.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.

6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. 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 primed and field finished.

B. Interior Doors, Non-Fire-Rated:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.

C. Fire-Rated Doors:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 18 gauge, 0.042 inch, 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 Core Material: Manufacturers standard core material/construction in compliance with requirements.
5. Door Thickness: 1-3/4 inches, nominal.

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 for Doors 3' wide and 7' high or less: 16 gauge, 0.053 inch, minimum.
2. Frame Metal Thickness for Doors Over 3' wide or 7' high: 14 gauge, 0.067 inch, minimum.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.

1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness for Doors 3' wide and 7' high or less: 16 gauge, 0.053 inch, minimum.
3. Frame Metal Thickness for Doors Over 3' wide or 7' high: 14 gauge, 0.067 inch, minimum.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.06 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
6. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
7. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".

8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.07 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

2.08 ACCESSORIES

A. Door Window Frames: Door window frames with glazing securely fastened within door opening.

B. Glazing: Section 088000, factory installed.

C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

D. 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.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.05 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

SECTION 083100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Wall- and ceiling-mounted access units.

B. Related Requirements:

1. Section 092116 - Gypsum Board Assemblies: Gypsum board applied to access doors.
2. Section 099123 - Interior Painting: Field paint finish.

1.02 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

D. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Source Limitations: Obtain access doors from single manufacturer.

B. Manufacturer: Subject to compliance with performance requirements, available manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
2. ACUDOR Products Inc: www.acudor.com/#sle.
3. Babcock-Davis: www.babcockdavis.com/#sle.
4. Best Access Doors: www.bestaccessdoors.com/#sle.
5. Nystrom, Inc: www.nystrom.com/#sle.

2.02 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:

1. Location: As indicated on drawings and as required to access concealed devices.

2. Panel Material: Aluminum.
3. Size: 12 by 12 inches.
4. Frame: Aluminum Extrusion recessed to provide similar edge to drywall bead to allow for finishing of wall surface.
5. Hinge: Wing hinge allows door panel to open to 90 degrees, and also allows for door panel to be removed from frame. Safety chain installed on door & frame for safety.
6. Gasket: Dust seal gasket
7. Latch: Concealed Touch Latches
8. Finish: Powder Painted White

B. Ceiling-Mounted Units:

1. Location: As indicated on drawings and as required to access, operate, and maintain above ceiling equipment and systems in gysum board ceilings or soffits. Refer to mechanical, plumbing, electrical, and fire protection drawings for additional information and requirements.
2. Panel Material: Aluminum extrusion with gypsum board inlay.
3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
4. Size: 12 by 12 inches.
5. Frame: Aluminum Extrusion recessed to provide similar edge to drywall bead to allow for finishing of ceiling surface.
6. Hinge: Wing hinge allows door panel to open to 90 degrees, and also allows for door panel to be removed from frame. Safety chain installed on door & frame for safety.
7. Gasket: Dust seal gasket
8. Latch: Concealed Touch Latches
9. Finish: Powder Painted White

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063.

B. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.04 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 083100

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. 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 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.

F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

G. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

H. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

L. 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.

M. 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).

N. 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).

O. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

P. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details. Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
   1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

C. Samples: Submit two samples illustrating finished aluminum surface, glass, infill panels, glazing materials.

D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

E. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

F. Designer's qualification statement.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
      a. Insulating Glass Certification Council (IGCC).
      b. Safety Glazing Certification Council (SGCC).

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
   1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
      a. North American Contractor Certification (NACC) for glazing contractors.
      b. Equivalent independent third-party ANSI accredited certification.

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. Correct defective Work within a five year period after Date of Substantial Completion.

B. 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.

C. 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. YKK AP America, Inc: www.ykkap.com/commercial/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Front-Set Style, Wind-Borne-Debris Resistance Tested:
   1. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Unitized, shop assembly.
   2. Glazing Rabbet: For 1 inch insulating glazing.
   3. Glazing Position: Front-set.
   4. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   5. Finish: Manufacturer's standard multi-coat superior performing organic coatings system.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   6. Finish Color: Custom, to match existing adjacent window frames.
   7. 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.
   8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   9. 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.
   10. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   11. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   12. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

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.
   3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
   4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.

B. Aluminum Flashing: Aluminum sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish: Two-Coat Fluoropolymer, AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: To match color of storefront framing

3. Thickness: 0.050 inches

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Fasteners: Stainless steel.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.06 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.

F. Color: Custom, to match existing adjacent window frames.

G. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 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. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.02 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.03 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. See Section 014000 - Quality Requirements for general testing and inspection requirements.

D. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

E. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
   1. Perform a minimum of two tests in each designated area as indicated on drawings.
   2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
   3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).

a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).

F. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

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 084313

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum windows for exterior locations.

B. All work included in this section is applicable to Add Alternate #1.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Sample Warranties: For manufacturer's warranties.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW.
2. Minimum Performance Grade: 30.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.34.

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 70 or greater.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of

joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

G. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

H. Outside-Inside Transmission Class (OITC): Rated for not less than 30 OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

I. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

2.3 ALUMINUM WINDOWS

A. Types: Provide the following types in locations indicated on Drawings:

1. Fixed.

B. Frames: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.

a. Tint: Clear.
b. Kind: Fully tempered.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second surface.
5. Color: Match existing adjacent.

D. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: Match existing adjacent window assemblies.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

    a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each as selected by Owner and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.
3. Electrified access control materials.

C. Related Sections:

1. Division 06 Section “Rough Carpentry”.
2. Division 08 Section “Door Schedule”.
3. Division 08 Section “Door Hardware Schedule”.
4. Division 08 Section “Hollow Metal Doors and Frames”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 105 - Installation of Smoke Door Assemblies.
6. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. CU Standard 281316 - Electronic Safety and Security Systems

1.2 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door

Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. 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.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.3 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware 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.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 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. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 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” heavy weight.
   b. Sizes from 3’1” to 4’0”: 5” heavy weight.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, 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.

5. Manufacturers:

   a. McKinney (MK) - TA/T4A Series, 5-knuckle. **PREFERRED BRAND**
   b. Hager Companies (HA) - BB Series, 5-knuckle.
   c. Bommer Industries (BO).

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. Hager Companies (HA). **PREFERRED BRAND**
b. Bommer Industries (BO).
c. Pemko Manufacturing (PE).

2.2 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. Manufacturers:

a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

C. Electric Door Wire Harnesses: Provide electric/data 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 and type 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. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.

b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series. Provide 6” QC-C006P on frame side.

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. 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.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

a. Burns Manufacturing (BU).
b. Door Controls International (DC).
c. Rockwood (RO).
d. Trimco (TC).

2.4 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. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. 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.
6. Keyway: Match Facility Restricted Keyway.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Security Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders to be factory keyed.

1. New security key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
2. Manufacturers:

a. Sargent (SA) - Degree DG2.
b. No Substitution.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

F. 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)

G. 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".

1. 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).

2.5 MORTISE 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. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

b. No Substitution.

B. Lock Trim Design: Sargent LNL.

2.1 INTEGRATED WIRED OUTPUT LOCKING DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Mortise Locks: Wiegand or Open Supervised Device Protocol (OSDP) output ANSI A156.13, Grade 1, mortise lockset with integrated card reader with or without keypad option, 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.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP 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.
2. Integrated reader supports the following credentials:

    a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
    b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
    c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
    d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
    e. NFC-enabled mobile phones
    f. PIN code only or PIN + credential with keypad option.

3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 500mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
5. Support end-of-line resistors contained within the lock case.
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 or OSDP output protocol.
8. Manufacturers:

    a. Sargent Manufacturing (SA) - SN200 8200 Series.
    b. No Substitution.

2.2 LOCK AND LATCH STRIKES

A. 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.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.3 SURFACE 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.
2. Standards: Closers to comply with UL-10C 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.
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 Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed 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. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. LCN Closers (LC) – 4040XP Series.
b. Sargent Manufacturing (SA) - 351 Series. **PREFERRED BRAND**

2.4 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 as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood (RO).
    c. Trimco (TC).

2.5 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 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. Manufacturers:

    a. Burns Manufacturing (BU).
    b. Rockwood (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed 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. Manufacturers:

a. Sargent Manufacturing (SA). **PREFERRED BRAND**
b. Norton Rixson (RF).
c. Glynn Johnson (GJ).

2.6 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 NFPA 252, Standard Methods of 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.

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.

F. Manufacturers:

1. Pemko (PE).
2. National Guard Products (NG).
3. Reese Enterprises, Inc. (RS).

2.7 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. Manufacturers:

a. Securitron (SU) - DPS Series.
b. Sentrol (SO) – 1078 x color

2.8 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.

2.9 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 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

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. DHI TDH-007-20: Installation Guide for Doors and Hardware.
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. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 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.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

END OF SECTION 087100

SECTION 087110 – DOOR HARDWARE SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.2 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.4 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.

1.5 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.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. SA - SARGENT
6. OT - Other
7. RF - Rixson
8. NO - Norton
9. MR - Markar

Hardware Sets

Set: 1.0
Doors: C100TA, C100TB

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Dormitory/Exit Lock	DG264 V20 8225 LNL	US26D	SA	087100
1	Core	DG2 6300 GGMK	US15	SA	087100
1	Surface Closer	351 P10 / 351 O	EN	SA	087100
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100
1	Mop Plate	K1050 6" high HVBEV BEV	US32D	RO	087100
1	Wall Stop	406	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 2.0
Doors: C1001Q, C1001QA, C1001T, C1001VB, C1001X

4	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Storeroom/Closet Lock	DG264 8204 LNL	US26D	SA	087100
1	Core	DG2 6300 GGMK	US15	SA	087100
1	Surface Closer	351 P10 / 351 O	EN	SA	087100
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100
1	Wall Stop	406	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 2.1

Doors: C1001B, C1001C, C1001CA, C1001S

4	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Storeroom/Closet Lock	DG264 8204 LNL	US26D	SA	087100
1	Core	DG2 6300 GGMK	US15	SA	087100
1	Surface Closer	351 CPS	EN	SA	087100
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 2.2

Doors: C1001H, C1001P, C1001U

4	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100
1	Storeroom/Closet Lock	DG264 8204 LNL	US26D	SA	087100
1	Core	DG2 6300 GGMK	US15	SA	087100
1	Surface Closer	351 P10 / 351 O	EN	SA	087100
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100
1	Wall Stop	406	US26D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 2.3

Doors: C1001D, C1001F, C1001G, C1001NA, C1001VA

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Storeroom/Closet Lock	DG264 8204 LNL	US26D	SA	087100
1	Core	DG2 6300 GGMK	US15	SA	087100
1	Surface Closer	351 CPS	EN	SA	087100
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100
3	Silencer	608-RKW		RO	087100

Set: 3.0

Doors: C1001-3

4	Hinge, Full Mortise	TA2714	US26D	MK	087100	
1	Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1	Access Control Mort Lock	DG264 SN200-82271-24V BIPS-03 LNL	US26D	SA	087100	⚡
1	Surface Closer	351 P10 / 351 O	EN	SA	087100	
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100	
1	Wall Stop	406	US26D	RO	087100	
3	Silencer	608-RKW		RO	087100	
1	ElectroLynx Frame Harness	QC-C006P		MK	087100	⚡
1	ElectroLynx Door Harness	QC-Cxxx Length as required		MK	087100	⚡
1	Power Supply	Provided by Div 28		SU	087100	⚡
1	Wiring Diagram	Wiring Diagram		OT		

Notes:
•Door normally closed and locked
•Unlocking of door by mechanical key alerts head end system of entry w/ out audit trail.
•Presenting proper credential unlocks outside lever and shunts DPS for authorized entry.
•RX tied to inside lever shunts DPS for set period of time.
•DPS alerts if door is held open longer than programmed time.
•Lock is Fail Secure.
•Free egress at all times.

Set: 3.1

Doors: C1001-4

4	Hinge, Full Mortise, Hvy Wt	T4A3786	US26D	MK	087100	
1	Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1	Access Control Mort Lock	DG264 SN200-82271-24V BIPS-03 LNL	US26D	SA	087100	⚡
1	Surface Closer	351 P10 / 351 O	EN	SA	087100	
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100	
1	Wall Stop	406	US26D	RO	087100	
3	Silencer	608-RKW		RO	087100	
1	ElectroLynx Frame Harness	QC-C006P		MK	087100	⚡
1	ElectroLynx Door Harness	QC-Cxxx Length as required		MK	087100	⚡
1	Power Supply	Provided by Div 28		SU	087100	⚡
1	Wiring Diagram	Wiring Diagram		OT		

Notes:
•Door normally closed and locked
•Unlocking of door by mechanical key alerts head end system of entry w/ out audit trail.
•Presenting proper credential unlocks outside lever and shunts DPS for authorized entry.
•RX tied to inside lever shunts DPS for set period of time.
•DPS alerts if door is held open longer than programmed time.
•Lock is Fail Secure.
•Free egress at all times.

Set: 4.0

Doors: C1001-1, C1001-2, C1032

8	Hinge, Full Mortise	TA2714	US26D	MK	087100	
1	Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
2	Flush Bolt	555	US26D	RO	087100	
1	Dust Proof Strike	570	US26D	RO	087100	
1	Access Control Mort Lock	DG264 SN200-82271-24V BIPS-03 LNL	US26D	SA	087100	⚡
1	Surface Closer	351 P10 / 351 O	EN	SA	087100	
1	Kick Plate	K1050 8" high HVBEV CSK	US32D	RO	087100	
2	Wall Stop	406	US26D	RO	087100	
2	Silencer	608-RKW		RO	087100	
1	ElectroLynx Frame Harness	QC-C006P		MK	087100	⚡
1	ElectroLynx Door Harness	QC-Cxxx Length as required		MK	087100	⚡
1	Position Switch	DPS-x-x		SU	087100	⚡
1	Power Supply	Provided by Div 28		SU	087100	⚡
1	Wiring Diagram	Wiring Diagram		OT		

Notes:
•Door normally closed and locked
•Unlocking of door by mechanical key alerts head end system of entry w/ out audit trail.
•Presenting proper credential unlocks outside lever and shunts DPS for authorized entry.
•RX tied to inside lever shunts DPS for set period of time.
•DPS alerts if door is held open longer than programmed time.
•Lock is Fail Secure.
•Free egress at all times.

Set: 5.0

Doors: C1001M

8	Hinge, Full Mortise	TA2714	US26D	MK	087100
2	Flush Bolt	555	US26D	RO	087100
1	Dust Proof Strike	570	US26D	RO	087100
1	Storeroom/Closet Lock	DG264 8204 LNL	US26D	SA	087100
1	Core	DG2 6300 GGMK	US15	SA	087100
1	Surf Overhead Stop	10-x36	630	RF	087100
1	Surface Closer	351 P10 / 351 O	EN	SA	087100
1	Wall Stop	406	US26D	RO	087100
2	Silencer	608-RKW		RO	087100

Set: 6.0

Doors: C1001L

1	Core	DG2 6300 GGMK	US15	SA	087100
1	Provided by Specialty Manufacturer	All Hardware by others.		OT	

Notes: Provide core/cylinder as directed by architect. Coordinate locking requirements w/ specialty door supplier.

END OF SECTION 087110

SECTION 090561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:

1. Resilient tile and sheet.
2. Carpet tile.
3. Thin-set ceramic tile and stone tile.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.

1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

B. Section 017419 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.

C. Section 033000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

D. Section 033000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

E. Section 035400 – Cast Underlayment: Patching, self-leveling material

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens).

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

1. Moisture and alkalinity (pH) limits and test methods.
2. Manufacturer's required bond/compatibility test procedure.

C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

D. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Include certification of accuracy by authorized official of testing agency.
8. Submit report directly to Owner.
9. Submit report to Architect.
10. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:

1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: As specified in Section 035400 – Cast Underlayment.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:

1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
   a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
   b. Removal of existing floor covering.
2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
   a. Do not attempt to remove coating or penetrating material.
   b. Do not abrade surface.
3. Preliminary cleaning.
4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
7. Specified remediation, if required.
8. Patching, smoothing, and leveling, as required.
9. Other preparation specified.
10. Adhesive bond and compatibility test.

11. Protection.

C. Remediations:

1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION 090561

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Performance criteria for gypsum board assemblies.
2. Metal stud wall framing.
3. Metal channel ceiling framing.
4. Resilient sound isolation clips.
5. Acoustic insulation.
6. Gypsum wallboard.
7. Joint treatment and accessories.

B. RELATED REQUIREMENTS

1. Section 061000 - Rough Carpentry: for wood blocking and plywood backing panels.
2. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
3. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
4. Section 083110 - Access Doors and Frames for providing access doors and frames in gypsum board assemblies.

1.02 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data.

C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.

D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

I. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

L. 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.

M. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

N. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

O. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

P. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

R. GA-216 - Application and Finishing of Gypsum Panel Products.

S. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.
2. Provide metal framing engineered to meet code requirements, project requirements, required heights, and the following deflection criteria. For gypsum board assemblies without applied rigid finishes L/240; for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling L/360. Lateral load 5 psf except at shafts. Lateral load at shafts shall be required based on analysis of equipment and systems using shafts.
3. Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements including special details associated with fireproofing and acoustic seals.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Product Certificates: For each type of code-compliance certification for studs and tracks.

E. 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.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Stack panels flat and supported on risers on a flat platform to prevent sagging and in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.02 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
   a. Post-Installed, Expansion Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or AC308 as appropriate for the substrate.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.

E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Armstrong World Industries, Inc.; Drywall Grid Systems.
   a. Chicago Metallic Corporation; Drywall Furring System.
   b. USG Corporation; Drywall Suspension System.
3. Performance Requirements: Ceiling support system shall support a live load of 6 psf minimum at L/240.

2.03 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Locate within 15 feet of end of each wall and repeat at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.

2.04 METAL FRAMING MATERIALS

A. Material and Product Requirements Criteria: AISI S201.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

1. Structural Grade: As required to meet design criteria.
2. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.

C. Manufacturers - Metal Framing, Connectors, and Accessories:

1. CEMCO: www.cemcosteel.com/#sle.
2. ClarkDietrich: www.clarkdietrich.com/#sle.
3. EB Metal U.S.; https://www.ebmetal.us/#sle.
4. MarinoWARE: www.marinoware.com/#sle.
5. Studco Building Systems: www.studcosystems.com/#sle.

6. Substitutions: See Section 016000 - Product Requirements.

D. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf for gypsum board assemblies without applied rigid finishes and L/360 at 5psf for gypsum board assemblies with applied rigid finishes such as tile, stone, wood paneling.

1. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.
   a. Minimum Base-Steel Thickness: 0.0190 inch.
   b. Depth: As indicated on Drawings.
2. Runners: U shaped, sized to match studs.
3. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   a. Minimum Base-Steel Thickness: 0.033 inch.
4. Cold-Rolled Channel Bridging: Steel, 0.053-inchminimum base-metal thickness, with minimum 1/2-inch wide flanges.
   a. Depth: 1-1/2 inches.
   b. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
5. Resilient Furring Channels: Single leg configuration; 1/2 inch channel depth, steel sheet members designed to reduce sound transmission. Strictly comply with manufacturer's installation instructions.
   a. Products:
      1) Same manufacturer as other framing materials.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Non Fire-Rated Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   a. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:
      1) ClarkDietrich Metal Framing; SLP-TRK Slotted Deflection Track.
      2) Marino\WARE; Slotted Track
4. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
b. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:
   1) ClarkDietrich Metal Framing; BlazeFrame DSL 2.
   2) MarinoWARE; FAS Track 1000
c. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

F. Non-structural Framing Accessories:

1. 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.
   b. Height: As required to support walls based on height indicated on Drawings.
   c. Products:
      1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.

2.05 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum Company: www.americangypsum.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
5. USG Corporation: www.usg.com/#sle.

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 and ceilings, unless otherwise indicated.
2. 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.
3. Thickness:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 1/2 inch.
4. Long Edges: Tapered
5. Paper-Faced Products:
   a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
   b. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
   c. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
   d. USG Corporation; Sheetrock Brand Firecode X Panels: www.usg.com/#sle.

C. Abuse Resistant Wallboard:

1. Application: Lab, Lab Support, Toilet Rooms, and High-traffic areas indicated.
2. Surface Abrasion: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Type: Fire-resistance-rated Type X, UL or WH listed.
7. Thickness: 5/8 inch.
8. Edges: Tapered.
9. Paper-Faced Products:
   a. American Gypsum Company; M-Bloc AR Type X: www.americangypsum.com/#sle.
   b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech: www.certainteed.com/#sle.
   c. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant: www.gpgypsum.com/#sle.
   d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Abuse Gypsum Board: www.goldbondbuilding.com/#sle.
   e. USG Corporation; Sheetrock Brand Mold Tough AR Firecode X 5/8 in.: www.usg.com/#sle.

D. Backing Board For Wet Areas: One of the following products:

1. Application: Surfaces behind tile in wet areas, including manufactured housing, tub and shower surrounds, and shower ceilings.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
   b. Products:
      1) CertainTeed Corporation; 5/8" GlasRoc Tile Backer Type X: www.certainteed.com/#sle.
      2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
      3) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com/#sle.
      4) USG Corporation; Durock Brand Glass-Mat Tile Backerboard 5/8 in. (15.9 mm): www.usg.com/#sle.

E. 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.
3. Edges: Tapered.

4. Products:
   a. CertainTeed Corporation; 1/2" Easi-Lite: www.certainteed.com/#sle.
   b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond High Strength LITE Gypsum Board: www.goldbondbuilding.com/#sle.
   c. USG Corporation; Sheetrock Brand UltraLight Panels 1/2 in. (12.7 mm): www.usg.com/#sle.

2.06 GYPSUM BOARD ACCESSORIES

A. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CertainTeed Corporation
   b. Knauf Insulation
   c. Owens Corning
   d. Rockwool (formerly Roxul)
2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

B. Acoustic Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products:
   a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
   b. Grabber Construction Products; Acoustical Sealant GSC.
   c. Pecora Corporation; AC-20 FTR.
   d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
   e. USG Corporation; SHEETROCK Acoustical Sealant.
2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Latex Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834 and the following requirements:
   a. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E90.
   b. Product has flame-spread and smoke-developed ratings of less than 25 per ASTM E84.

C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Corner Beads: Low profile, for 90 degree outside corners.

2. L-Trim with Tear-Away Strip: Sized to fit 1/2-inch thick gypsum wallboard.
3. Expansion Joints:
   a. Fire-Resistance Rated: 1 hour when joint system tested in accordance with UL 2079.
   b. Type: V-shaped metal with factory-installed protective tape.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   a. Tile Backing Panels: As recommended by panel manufacturer.
2. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   c. Fill Coat: For second coat, use setting-type, sandable topping compound.
   d. Finish Coat: For third coat, use setting-type, sandable topping compound.

E. Joint Compound for Glass-Mat, Tile Backing Panels: As recommended by backing panel manufacturer.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch 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.

B. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 **PREPARATION**

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.

C. Studs: Install framing system components according to spacings indicated on Drawings, but not greater than spacings required by referenced installation standards for assembly types.

1. Extend partition framing to structure, to ceiling, or 6" above ceiling as indicated in the drawings.
   a. Partitions Terminating at Ceiling: Attach ceiling runner securely to to ceiling framing in accordance with details and manufacturer's recommendations.
   b. Partitions Terminating 6" above ceiling: Provide diagonal bracing attached to top runner as required to properly brace wall assembly, including but not limited to: corners, ends, and door jambs. Spacing shall not exceed 4'-0" o.c.
   c. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
2. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/16 inch from the plane formed by faces of adjacent framing.

D. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
3. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

E. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

G. Blocking: Install blocking for support of:

1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.
7. Wall-mounted handrails.
8. Wall mounted furnishings and equipment.
9. Other items as indicated to receive blocking on the drawings.

3.04 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 two beads continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 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 vertically, parallel to framing, with ends and edges occurring over firm bearing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

3.07 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Where indicated on Drawings.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 2: Walls to receive acoustical wall panels or 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.

C. 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.

D. 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.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.09 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

3.10 PROTECTION

A. Protect installed gypsum board assemblies from weather, condensation, direct sunlight, construction, and other causes during remainder of construction operations.

B. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116

SECTION 093000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic trim.

D. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.

C. 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.

D. 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.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive.

F. 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.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units.

L. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar.

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

N. 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.

O. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.

P. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.

S. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar.

T. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

U. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

W. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings – Showing tile layout and details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement:

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

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 Tile: 5 percent of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Maintain one copy of ANSI A108/A118/A136, TCNA (HB), and TCNA (HB-GP) on-site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. 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 and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: See Finish Legend on drawings for manufacturers and products .

B. Glazed Wall Tile: ANSI A137.1 standard grade.

C. Porcelain Tile: ANSI A137.1 standard grade.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.

1. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified 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 wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As indicated on drawings.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.

1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.

B. 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 gap, minimum.
2. Fluid or Trowel Applied Type:
   a. Material: Synthetic rubber or Acrylic.
   b. Thickness: 20 mils, maximum.

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 gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
   a. Material: Synthetic rubber or Acrylic.
   b. Thickness: 25 mils, minimum, dry film thickness.

C. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

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. Test in accordance with Section 090561.
2. 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.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile 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 bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. 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 high performance grout.

1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 093000

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles for interior ceilings.
2. Fully concealed, direct-hung, suspension systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.
6. Minimum Drawing Scale: 1/8 inch = 1 foot.

D. Evaluation Reports: For each acoustical tile ceiling suspension system, from ICC-ES.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL TILES <ACT-1>

A. Basis-of-Design:

1. Manufacturer: Armstrong
2. Tile: Ultima #1911
3. Edge: 15/16” Beveled Tegular
4. Thickness: 3/4”
5. Size: 24”x24”
6. Color: White
7. Light Reflectance (LR): Not less than 0.88
8. Ceiling Attenuation Class (CAC): Not less than 35.
9. Noise Reduction Coefficient (NRC): Not less than 0.75.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

A. Basis-of-Design:

1. Manufacturer: Armstrong
2. Grid: Prelude
3. Size: 15/16”
4. Structural Classification: Heavy-duty system.
5. Color: White

2.5 ACCESSORIES

A. Attachment Devices: Manufacturer recommended fasteners, size for five times the design load indicated in ASTM C635/C635M, unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load will be less than yield stress of wire, but not less than 0.135-inch-diameter wire.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. Finish: Painted white.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
3. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

C. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

B. ASTM F1861 - Standard Specification for Resilient Wall Base.

C. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

E. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers.

1.04 SUBMITTALS

A. See Section 013000 - Administrative 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. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.01 SHEET FLOORING [RF-2]

A. Sheet Flooring: Homogeneous without backing, with color and pattern throughout full thickness.

1. Minimum Requirements: Comply with ASTM F1913.
2. Thickness: 0.080 inch nominal.
3. Seams: Heat welded.
4. Color: As indicated on drawings.

B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.02 TILE FLOORING [RF-1]

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.

1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
2. Size: 12 by 12 inch.
3. Thickness: 0.125 inch.
4. Color: As indicated on drawings.

2.03 RESILIENT BASE [WB-1]

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
2. Height: 4 inches.
3. Thickness: 0.125 inch.
4. Finish: Satin.
5. Profile: Straight
6. Length: Roll.
7. Color: As indicated on drawings.
8. Accessories: Premolded external corners and internal corners.

2.04 RESILIENT BASE [WB-2]

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
2. Height: 4 inches.
3. Thickness: 0.125 inch.
4. Finish: Satin.
5. Profile: Straight
6. Length: Roll.
7. Color: As indicated on drawings.
8. Accessories: Premolded external corners and internal corners.

2.05 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

B. Moldings, Transition and Edge Strips: Same material as flooring.

C. Filler for Coved Base: Plastic.

D. 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 in accordance with Section 090561.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 090561.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 090561.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Cut sheet at seams in accordance with manufacturer's instructions.

C. Seal seams by heat welding where indicated.

3.05 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096500

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096500 - Resilient Flooring for resilient wall base and accessories installed with carpet tile.
3. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Sample Warranty: For special warranty.

F. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.4 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.5 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE <CPT-1>

A. Basis-of-Design: As indicated in Finish Schedule.

B. Color: As indicated in Finish Schedule.

C. Pattern: As indicated in Finish Schedule.

D. Installation: As indicated in Finish Schedule.

2.2 INSTALLATION ACCESSORIES

A. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate acceptable to Manufacturer.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum relative humidity level acceptable to Manufacturer.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Paints: Acceptable manufacturers:
1. Benjamin Moore: www.benjaminmoore.com

2. PPG Paints: www.ppgpaints.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated in Finish Schedule.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacture.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.

3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Latex System:

a. System:

1) Block Filler: Block filler, latex, interior/exterior.
2) Intermediate Coat: Latex, interior, matching topcoat.
3) Topcoat: Latex, interior (MPI Gloss Level 4).

b. Location: Exposed CMU Outside of Lab and Lab Support Areas

2. Pre-Catalyzed Waterborne Epoxy Semi-Gloss:

a. System:

1) Block Filler: Block filler, latex, interior/exterior.
2) Intermediate Coat: Pre-Catalyzed Waterborne Epoxy, matching topcoat.
3) Topcoat: Pre-Catalyzed Waterborne Epoxy (MPI Gloss Level 5).

b. Location: Exposed CMU in Lab and Lab Support Areas

B. Steel Substrates:

1. Latex System, Alkyd Primer:

a. System:

1) Prime Coat: Primer, alkyd, anti-corrosive, for metal.
2) Intermediate Coat: Latex, interior, matching topcoat.
3) Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5).

b. Location: Steel Substrates Outside of Lab and Lab Support Areas

2. Pre-Catalyzed Waterborne Epoxy:

a. System:

1) Prime Coat: Primer, alkyd, anti-corrosive, for metal.
2) Intermediate Coat: Pre-Catalyzed Waterborne Epoxy, matching topcoat.
3) Topcoat: Pre-Catalyzed Waterborne Epoxy (MPI Gloss Level 5).

b. Location: Steel Substrates in Lab and Lab Support Areas

C. Wood Substrates: Wood trim.

1. Latex over Latex Primer System:

a. System

1) Prime Coat: Primer, latex, for interior wood.
2) Intermediate Coat: Latex, interior, matching topcoat.
3) Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5).

b. Location: Exposed Wood Office Area

D. Gypsum Board Substrates:

1. High-Performance Architectural Latex System:

a. System

1) Prime Coat: Primer sealer, latex, interior.
2) Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
3) Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4).

b. Location: Gypsum Board Outside of Lab and Lab Support Areas

2. Pre-Catalyzed Waterborne Epoxy:

a. System:

1) Prime Coat: Primer, alkyd, anti-corrosive, for metal.
2) Intermediate Coat: Pre-Catalyzed Waterborne Epoxy, matching topcoat.
3) Topcoat: Pre-Catalyzed Waterborne Epoxy (MPI Gloss Level 4).

b. Location: Steel Substrates in Lab and Lab Support Areas

END OF SECTION 099123

SECTION 101423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

1.02 REFERENCE STANDARDS

A. New York State Accessibility Code 2017 w/ Supplement 1

B. ADA Standards - 2010 ADA Standards for Accessible Design.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

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.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
2. Show locations of electrical service connections.
3. 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.

D. Samples: Submit one samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

E. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.

F. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

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

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store under cover and elevated above grade.

D. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

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.

2.02 PANEL SIGNAGE

A. Contractor shall coordinate with Owner’s existing campus and building signage standards, coordinate with Owner.

B. Panel Materials:

1. Material 1: Stainless Steel, #4 Finish (Grain to run vertically) with finish returns
2. Material 2: Aluminum, Painted, with finish returns
3. Material 3: Acylic, clear
4. Material 4: Galvanized Steel, Painted Black

C. Colors:

1. Color 1: Paint, RAL 9016 Traffic White
2. Color 2: Paint, RAL 7040 Window Grey
3. Color 3: Lithopaint, Gray

D. Panel Signage [S1]:

1. Application: Room signs.
2. Description: Flat signs with raised tactile characters.
3. Sign Size: 2 inches by 6 inches.
4. Thickness: 1/4 inch.
5. Color and Font, unless otherwise indicated:
   a. Character Font: ROTIS SANS SERIF 55 ROMAN.
   b. Character Case: Upper.
6. Material and Colors:
   a. Sign Panel: Material 2, Color 1
   b. Tactile Letters / Pictogram: Material 2, Color 2
   c. Braille: Material 2, Color 1
7. Profile: Flat panel without frame.
8. Tactile Letters: Raised 1/32 inch minimum.
9. Braille: Grade II, ADA-compliant.
10. One-Sided Wall Mounting: Tape adhesive.

E. Panel Signage [S2]:

1. Application: Room signs.
2. Description: Flat signs with raised tactile characters.
3. Sign Size: 6 inches by 6 inches.
4. Thickness: 1/4 inch.
5. Color and Font, unless otherwise indicated:
   a. Tactile Characters: FRUTIGER BOLD.
   b. Visual Characters: FRUTIGER ROMAN
   c. Character Case: Upper.
6. Material and Colors:
   a. Sign Panel: Material 2, Color 1
   b. Tactile Letters / Pictogram: Material 2, Color 2
   c. Braille: Material 2, Color 1
7. Profile: Flat panel without frame.
8. Characters:
   a. Room Numbering to be Raised Tactile Letters: Raised 1/32 inch minimum.
   b. Room Name to be Silk-Screened (Visual)
9. Braille: Grade II, ADA-compliant.
10. One-Sided Wall Mounting: Tape adhesive.

F. Panel Signage [S3 and S4]:

1. Application: Toilet room signs.
2. Description: Flat signs with raised tactile characters and pictogram.
3. Sign Size: 6 inches by 8 inches.

4. Thickness: 1/4 inch.
5. Color and Font, unless otherwise indicated:
   a. Tactile Characters: ROTIS SANS SERIF 55 ROMAN.
   b. Character Case: Upper.
6. Material and Colors:
   a. Sign Panel: Material 2, Color 1
   b. Tactile Letters / Pictogram: Material 2, Color 2
   c. Braille: Material 2, Color 1
7. Profile: Flat panel without frame.
8. Raised Tactile Letters: Raised 1/32 inch minimum.
9. Pictogram: Raised 1/32 inch minimum.
10. Braille: Grade II, ADA-compliant.
11. One-Sided Wall Mounting: Tape adhesive.

2.03 ACCESSORIES

A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that power and data service is correctly sized and located to accommodate panel signs.

C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage; repair or replace damaged items.

END OF SECTION 101423

SECTION 102113.17 - PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking and supports.

B. Section 102800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 4" by 4" inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
   2. ASI Accurate Partitions: www.asi-accuratepartitions.com/#sle.
   3. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
   4. Partition Systems International of South Carolina; Phenolic Toilet Partitions:

www.psisc.com/#sle.

5. Substitutions: Section 016000 - Product Requirements.

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted unbraced.
   1. Color: Single color as selected.

B. Doors:
   1. Thickness: 3/4 inch (19 mm).
   2. Width: 32 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 58 inch.

C. Panels:
   1. Thickness: 1/2 inch.
   2. Height: 58 inch.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 3/4 inch.
   2. Width: As required to fit space; minimum 3 inch.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.

C. Attachments, Screws, and Bolts: Stainless-steel, tamper-proof type.

D. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return outswinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 102113.17

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.
2. End-wall guards.

B. Related Requirements:

1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner and End-Wall Guards: 12 inches long. Include example top caps.

D. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

A. Surface-Mounted, Plastic-Cover Corner Guards <CG-2>: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover installed over aluminum retainer; including mounting hardware; fabricated with 90-degree turn to match wall condition.

1. Basis-of-Design: CS Specialties, Acrovyn SFS Series
2. Cover: Extruded rigid plastic, minimum 0.60-inch wall thickness; in dimensions and profiles indicated on Drawings.

a. Profile: Nominal 2-inch-long leg.
b. Height: As shown on Drawings.
c. Color and Texture: As indicated on Finish Schedule.

3. Continuous Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 END-WALL GUARDS

A. Surface-Mounted, Plastic-Cover, End-Wall Guard <CG-1>: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover installed over continuous retainer; including mounting hardware.

1. Basis-of-Design: CS Specialties, Acrovyn FSC-25
2. Cover: Extruded rigid plastic, minimum 0.60-inch wall thickness; in dimensions and profiles indicated on Drawings.

    a. Profile: Nominal 2-inch-long leg.
    b. Height: As shown on Drawings.
    c. Color and Texture: As indicated on Finish Schedule.

3. Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.6 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

END OF SECTION 102600

SECTION 102800 – TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Public-use washroom accessories.

1.2 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI 117 - Standard Specification for Structural Glued Laminated Timber of Softwood Species; 2020.

C. Cornell Design and Construction Standards – 102800 Restroom Accessories

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

PART 2 - PRODUCTS

2.1 GENERAL

A. All work relative to restroom construction, alteration, modification and conversion under-taken within Cornell University facilities are required to comply with the provisions of the current edition of the Building Code of New York State, ANSI 117.1- 2017, and the 2010 ADA Standards for Accessible Design (most current adopted versions).

B. Dispensers that utilize infrared sensors are not allowed.

C. Projects will purchase the accessories through Cornell Building Care. One exception is soap dispensers, which are furnished by Cornell to the project.

D. Location of dispensers and in proximity of lavatory and waste receptacles to be in proximity of exit doorway.

2.2 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: Soap Dispensers.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Toilet Tissue (Roll) Dispenser:

1. Basis-of-Design: Georgia Pacific, Compact Coreless
2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Paper Towel (Roll) Dispenser:

1. Basis-of-Design: Georgia Pacific 54338A
2. Description: Push paddle, roll paper towel dispenser.
3. Mounting: Surface mounted.
4. Material and Finish: ABS plastic, gray.

D. Waste Receptacle:

1. Basis-of-Design: Slim Jim Waste Container (RMD 3540),
2. Mounting: Freestanding.
3. Minimum Capacity: 32 gal.
4. Material and Finish: Gray.

E. Liquid-Soap Dispenser:

1. Basis-of-Design: Deb Soap - Proline Curved Black 1 liter Unit (SBS 91128)
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 1-liter cartridges.
5. Materials: Plastic, black.
6. Furnished: Cornell
7. Installed: Contractor

F. Grab Bar:

1. Basis-of-Design: Bobrick #B-5806 Series
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

G. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design: Impact Products 25125200 or approved equal.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: ABS plastic, white.

H. Sanitary-Napkin Dispenser:

1. Basis-of-Design: Bobrick #B370639
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

I. Seat-Cover Dispenser:

1. Basis-of-Design: Bobrick #B-4221
2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

J. Shelf:

1. Basis-of-Design: Bobrick #B-295 x 16
2. Description: Commercial Restroom Shelf.
3. Nominal Size: 16-inches long, 5-inches wide.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

K. Sink Mirror Unit:

1. Basis-of-Design: Bobrick #B-290 Series

2. Frame: Stainless steel channel.

a. Corners: Welded and ground smooth.

3. Size: As indicated on Drawings.

L. Full Length Mirror Unit:

1. Basis-of-Design: Bobrick #B-290 Series
2. Frame: Stainless steel channel.

a. Corners: Welded and ground smooth.

3. Size: As indicated on Drawings.

M. Coat Hook:

1. Basis-of-Design: Bobrick #B-542
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for Portable fire extinguisher.
2. Portable fire extinguisher.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-mounting method and relationships of box and trim to surrounding construction.

2. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

D. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.3 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Basis-of-Design: JL Industries, Academy Series Aluminum

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

D. Recessed Cabinet:

1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Cabinet Trim Material: Aluminum sheet.

F. Door Material: Aluminum sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Acrylic sheet.

1. Acrylic Sheet Color: Clear transparent acrylic sheet.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

        1) Location: Applied to cabinet door.
        2) Application Process: Silk-screened.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

K. Materials:

1. Aluminum: ASTM B221 (ASTM B221M) for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

    a. Finish: Powder coat, white.

2. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 0.090 inch-thick.

2.4 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Basis-of-Design: JL Industries, Cosmic Series – Multi-Purpose ABC Dry Chemical Fire Extinguisher
2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Aluminum.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4A-80B:C nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.5 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.

2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fire-Protection Cabinets: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 115313.10 - LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including project conditions, contract execution and administrative requirements outlined in the Division 01 Specification Sections, shall apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Bench-top High-Performance Laboratory Fume Hoods.
2. Service fixtures (ie. water, gas, etc.) and electrical service fittings in fume hoods.
3. Piping and wiring within service fittings, light fixtures, switches, and other electrical devices internal to the hood.
4. Fume hood base cabinets and adjustable supports.
5. Work Surfaces within fume hoods.
6. Laboratory sinks and cup sinks in fume hoods.
7. Filler panels and ceiling enclosures for fume hoods.

B. Related Divisions/ Sections:
1. Division 22: Provide plumbing utilities final connections to fume hoods.
2. Division 23: Provide exhaust duct, controls systems and equipment, and connection of hoods and associated controls to building systems.
3. Division 26: Provide final electrical utility connections to hoods.

1.1 BASIS OF DESIGN

A. It is the intent of this specification to use the Basis of Design Manufacturer (BOD) as the standard of construction for laboratory furniture for this project. The construction standards of this product line shall provide the basis for quality and functional installation for listed alternative manufacturers

B. Procedures for obtaining approval for substitutions are defined in Division 01.

C. During the Bidding process the option of clarifying deviations to the specified design, construction, or materials will be reviewed. Without the approval of clarifications, the requirements of the specification will prevail.

1.2 REFERENCES

A. The laboratory hoods must conform to the following regulations and standards.
1. SEFA 1-2010, Scientific Equipment and Furniture Association , Recommended Practices for Laboratory Fume Hoods

2. SEFA 8-2010, Recommended Practices for Laboratory Grade Metal Casework, 8.0 Cabinet Surface Finish Tests
3. NFPA 45-2011, National Fire Protection Association, Fire Protection for Laboratories Using Chemicals
4. ASTM E84-09C, ANSI 2.5, NFPA 255, UL 723, UBC 8-1 (42-1), Standard Test method for Surface Burning Characteristics of Building Materials
5. ASHRAE 110-2016, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Method of Testing Performance of Laboratory Fume Hoods
6. ANSI/AIHA Z9.5-2011, American Industrial Hygiene Association, Laboratory Ventilation
7. OSHA, Federal Register 29 CFR Part 1910, Occupational Safety & Health Administration, U.S. Department of Labor, Occupational exposures to hazardous chemicals in laboratories.

B. The laboratory fume hoods must carry the ETL listed mark for the following.
1. UL 61010-1 (formerly 3101-1), Underwriters Laboratories Inc., Electrical Equipment for Laboratory Use
2. CAN/CSA C22.2 No. 61010-1, Canadian Standards Association, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
3. UL 1805, Underwriters Laboratories Inc., Standard for Laboratory Hoods and Cabinets

1.3 PERFORMANCE REQUIREMENTS

A. General Design Requirements
1. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, contain and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
2. Fume hood shall be factory designed to function as either a by-pass fume hood or as a variable air volume fume hood based on the requirements scheduled on the drawings.
3. Structure and Materials of construction
   a. Hoods are of double-wall construction
   b. Powder-coated, cold rolled steel exterior
   c. Galvanized steel support members
   d. Sheet molded composite panel internal liner
4. Baffles
   a. Baffle slot pattern designed to optimize face velocity profile.
   b. Moving or adjustable baffles are not acceptable
5. Sash
   a. Maximum opening is 28".
   b. Unobstructed viewing height is 37.5".
   c. Hood incorporates a perforated sash handle to bleed air into the hood chamber directing fume concentrations away from the user's breathing zone.
6. Airfoil:
   a. Hoods are provided with an air foil across the bottom of the sash area to allow airflow into the hood regardless of user's position.
7. Besides the exhaust blower, no additional blowers are required for specified containment.
8. Access for maintenance is from both the front, interior, and exterior sides of the hood.
9. Services:
   a. Furnishing and delivering all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings.
   b. Plumbing fittings mounted on the fume hood superstructures shall be pre-plumbed.

c. Final plumbing, HVAC, and electrical connections are the responsibility others.
d. All electrical services shall be pre-wired to a single point internal junction box at the top right of the hood.

B. Containment
1. The purpose of this section is to set a standard of performance for the bidder's laboratory fume hood before award of contract, and may not necessarily represent the operating conditions of the hoods after installation. Before or after award of contract, owners may require representative witness to said testing at their option, with failure to meet passing criteria as grounds for rejection of the bidder. Test data shall be provided at no cost to the owner.
2. Evaluation of manufacturer's standard product shall take place in manufacturer's test facility meeting the following criteria.
a. Lab to be located at manufacturer's place of business for the testing of bench-mounted laboratory hoods in accordance with ASHRAE Standard 110.
b. Room shall accommodate hoods up to 16' wide, while maintaining sufficient area so that a minimum of 15 feet of clear space is available in front of and 5' on both sides of hoods for viewing tests.
c. The facility's ventilation system shall have adequate heating and air conditioning so that room air temperatures can be maintained within the desired ranges.
d. One hundred percent non-recirculated air to be both carbon and HEPA filtered to ensure removal of contaminants that could interfere with containment testing before entering the lab.
e. Make-up air to the test room shall be ceiling-supplied through any combination of multiple diffusers to either minimize adverse airflow, or increase it depending on test objectives.
f. Exhaust volumes shall be computer controlled and measured via AMCA calibrated orifices and flow station at each exhaust trunk.
g. Room pressurization must be digitally monitored, and variable depending on test objectives.
h. All equipment must be properly calibrated.
i. Qualified personnel familiar with the laboratory and its operation shall be available to perform the test.
j. Include the following instrumentation and test equipment:
1) Properly calibrated hot wire thermal anemometer capable of measuring air velocities from 10 to 600 ft/minute; correlate with computer data acquisition format to provide simultaneous readings at all points.
2) Theatrical smoke generator or other source of high volume smoke.
3) Smoke tubes or other source of localized smoke.
4) Leakmeter with traceable calibration, calibrated just before test, to indicated concentration of sulfur hexafluoride.
5) Tracer gas: Sulfur hexafluoride supplied from a cylinder with two stage regulator.
6) Adjustable mannequin, 5' 0' to 5'8" in height, with reasonable human proportions, clothed in a smock
7) Inclined manometer with graduations no greater than 0.2 inch of water.
8) Ejector system: Tracer gas ejector built to specific ASHRAE-110 requirements.
9) Critical orifice: Sized to provide tracer gas at four or eight liters per minute at an upstream pressure sufficient to maintain release rate.
10) Data acquisition software to include HoodPro™ and LabMeasurePro™ from Exposure Control Technologies, Inc.

3. Hood shall be tested to ASHRAE 110 modified test method as detailed below.
4. containment testing shall show both operational containment and product containment with face velocity controls, motorized baffles, integral auxiliary make up, and supply fans systems off.
5. Fume hood sashes shall be placed in their full open position, at least 28” from the work surface, unless noted otherwise.
6. Ambient Temperature: 68 to 74 degrees F
7. Average Face Velocity: Face velocity average shall be 60 fpm, as noted below in subsection 8.d, parts 1 and 2, plus or minus 5%.
    a. An imaginary grid is formed comprised of equal 12” by 12” squares, or smaller, across the face opening of the laboratory hood. Airflow velocity readings are taken at the intersections of these grids with calibrated hot wire anemometer over a twenty second period of time. Probes shall communicate readings to a computer data acquisition package, which will provide an average of each reading over the one-minute period and also an overall average upon completion of data acquisition. Face velocity shall be determined by averaging readings at the hood face.
    b. Average face velocity must be achieved without exceeding the CFM noted in part C.
8. Tracer Gas Detection: Hood shall achieve a rating of 4.0AM0.00 maximum average and 4.0AM0.01 maximum spike (unless specifically otherwise noted), wherein:
    a. 4.0 = tracer gas release in liters/minute, AM = as manufactured, 0.01 = tracer gas in parts per million (PPM)
    b. With the ejector body 6" from the rear of the sash plane, the test shall be conducted for each ejector position noted.
        1) Left position with ejector 12" from the left interior wall.
        2) Center position with ejector equidistant from the sidewalls.
        3) Right position with ejector 12" from the right interior wall.
    c. Install mannequin positioned in front of the hood, centered on the ejector.
    d. Detector probes shall be placed 3” in front of the sash plane. The test shall be conducted for each detector probe position and corresponding face velocity.
        1) Detector probe in the region of the nose and mouth of the mannequin. Test with average face velocity of 60 fpm.
        2) With the mannequin height reduced 4”, place detector probe in the chest of the mannequin, and even with the height of the ejector. Test with average face velocity of 60 fpm.
    e. Open tracer gas valve, and collect readings with a computer data acquisition package, which is capable of monitoring and visually recording a minimum of one reading per second for a minimal five minute time period for each position.
    f. The single control rating of the fume hood shall be the results of the test position yielding the highest average levels of tracer gas in any of the six mannequin/ejector configurations.
    g. With the ejector and mannequin in the center position, detector probe in the region of the nose and mouth of the mannequin, average face velocity of 60 fpm, tracer gas released, and concentration recorded, open and close the sash in a smooth motion. Test to be repeated three times, with peak values of 0.01 PPM or less.
    h. With the mannequin removed, the periphery of the hood is traversed by the probe at 1” in front of the hood opening at a rate of 3 inches per second. The hood shall have a maximum perimeter reading of 0.03 PPM or less.
9. Flow Visualization:
    a. Test the operation of the lower air bypass airflow opening and hood periphery by introducing light smoke under the air foil, and around the perimeter of the sash

opening. If any smoke that enters the hood reverses directions and escapes from any of these locations, the hood fails this portion of the test and receives no rating.

b. Introduce smoke along both walls and the hood floor in a line parallel to the hood face and 6 inches (152 mm) back into the hood. Define air movement toward the face of the hood as reverse airflow and define lack of movement as dead air space. All smoke should be carried to the back of the hood and out.

c. Introduce a large volume of smoke at the work surface in the center of the hood, and 6" inside the plane of the sash. Define air movement toward the face of the hood as reverse airflow and define lack of movement as dead air space. All smoke should be carried to the back of the hood and out.

d. All data on the above, 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. Performance test data for a 6' representative hood 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).

C. Efficiencies

1. The fume hood shall maintain constant volumetric rate (+/- 5 CFM) and static pressure losses (+/- 0.01" H2O) across all sash positions, unless the hood has a restricted by-pass for use with a variable air volume (VAV) system.
2. The fume hood shall demonstrate a minimization of the volumetric rate of air (CFM) requirement at any given face velocity. Required CFM to achieve desired face velocity shall not exceed that which is noted in the chart below.
3. The fume hood shall demonstrate a minimization of static pressure loss (inches of H2O) at any given CFM. Static pressure loss at desired face velocity, and corresponding CFM, shall not exceed that which is noted in the chart below.

Face Velocity (fpm) Sash at 28" Open	Airflow, Volumettric Rate (CFM) @ Static Pressure (inches of H2O)					
	3' Hood	4' Hood	5' Hood	6' Hood	7' Hood	8' Hood
100	495, 0.13"	725, 0.27"	955, 0.34"	1180, 0.46"	1410, 0.23"	1640, 0.31"
80	395, 0.08"	580, 0.17"	765, 0.22"	945, 0.29"	1125, 0.15"	1310, 0.20"
60	295, 0.05"	435, 0.10"	575, 0.12"	710, 0.17"	845, 0.08"	985, 0.11"
50*	250, 0.03"	365, 0.07"	480, 0.09"	590, 0.11"	705, 0.06"	820, 0.08"
Face Velocity (fpm) Sash at 18" Open	Airflow, Volumettric Rate (CFM) @ Static Pressure (inches of H2O)					
	3' Hood	4' Hood	5' Hood	6' Hood	7' Hood	8' Hood
100	310, 0.05"	450, 0.11"	595, 0.13"	735, 0.18"	880, 0.09"	1025, 0.12"
80	250, 0.03"	365, 0.07"	480, 0.09"	590, 0.11"	705, 0.06"	820, 0.08"
60	185, 0.02"	270, 0.04"	360, 0.05"	440, 0.07"	525, 0.03"	615, 0.04"

D. Noise Criterion: The hood shall have a Noise Criterion (NC) rating of less than 50; measured 36" in front of the hood with full open sash, at 100 fpm face velocity. NC is a factor of sound pressure level (dB) and frequency.

E. Illumination: Shall be a minimum average of 80 foot-candles inside the work area. Work area is defined as the area inside the lined portion of the fume hood, from the face of baffle to sash plane, from interior left to interior right, and from the work surface to a height of 28 inches.

F. Materials of Construction: Interior and Exterior materials of construction and finishes shall meet the requirements in Part 2 of this specification.

1.4 QUALITY ASSURANCE

A. Fume hoods shall be designed, including comprehensive engineering analysis, by a qualified, licensed Professional Engineer.

B. Manufacturer's Qualifications
1. ISO 9001 Certified manufacturing plant and processes.
2. Ten installations of equal or larger size and requirements. Provide contact at each.
3. Only hood manufacturers who have had fume hoods as a principal product for 30 years are considered.

C. Fume hoods shall be Made in America
1. 95% or more of raw material and component suppliers shall be United States based.
2. Stainless and cold rolled steel used in manufacturing shall be sourced from United States steel mills.
3. Final product must be fabricated and assembled within the United States of America.
4. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.

D. Supply all equipment in accordance with this specification. Offering a product differing in materials, construction, or performance from this specification requires written approval obtained seven days or more before the proposal deadline.

E. The owner/architect reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures the owner greater integrity of product.

F. Manufacturer's warranty against defects in material or workmanship on its fume hoods will be for 1 year from date of installation or 2 years from date of purchase, whichever is sooner, and includes replacement of parts (except lamps) and labor.

1.5 SUBMITTALS

A. Laboratory hood specification sheets and product manuals shall be submitted by the hood manufacturer upon request, and include safe and proper operation and maintenance information.

B. Shop Drawings: Include plans, elevations, sections, and details.
1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.
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. Provide face opening, volumetric rates, and static pressure drop data.

C. Submit a document detailing the information supplied on the Hood Safety Practices Label to verify compliance to specifications.

D. Informational Submittals
1. Product Test Reports: Showing compliance with specified performance requirements, including NEBB representative test report as defined previously.
2. Independent validation:
a. Written verification that the laboratory fume hoods carry the ETL listed mark for the following.
1) UL 61010-1 (formerly 3101-1), Underwriters Laboratories Inc., Electrical Equipment for Laboratory Use
2) CAN/CSA C22.2 No. 61010-1, Canadian Standards Association, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
3) UL 1805, Underwriters Laboratories Inc., Standard for Laboratory Hoods and Cabinets
b. Written verification that 230 volt model fume hoods carry the CE conformity marking as required by the Council of European Communities.
c. Written verification from an outside testing agency confirming coating compliance to SEFA 8-2010, Recommended Practices for Laboratory Grade Metal Casework, 8.0 Cabinet Surface Finish Tests
3. Documentation of ISO 9001 Certified manufacturing plant and processes.
4. List of five installations (of equal or larger size and requirements) is available upon request. Provide contact at each.
5. Declaration of Made in America. Owner reserves the right to evaluate Made in America claims for compliance with the Bureau of Consumer Protection.

E. Material Submittals
1. Samples for Verification: of the hood exterior wall material, interior liner and baffle material, epoxy work surface material, and color selection chips are available from the hood manufacturer upon request.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

B. Schedule delivery of equipment so that spaces are sufficiently complete that equipment can be installed immediately following delivery.

1.7 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Labconco Corporation, 8811 Prospect Avenue, Kansas City, Missouri 64132

B. Alternate Manufactures: provided the hoods meet the requirements of this specification
1. Kewaunee
2. Mott Manufacturing

2.2 PRODUCTS

A. Basis-of-Design Lab Hood: Labconco Protector XL

2.3 MATERIALS

A. Hood Interior Liner and Baffle
1. Liner material must comply with UL 1805, and be listed within NRTL test report as proof of compliance.
2. General Material Properties
a. Nonflammable, corrosion and chemical-resistant
b. Sheet molded homogenous polyester panels
c. Minimum thickness is 3/16"
d. Smooth, white finish
3. Mechanical Properties
a. Tensile Strength: 7,500 PSI (51.7 Mpa)
b. Tensile Modulus: 1.7 x 10^6 PSI (11,700 Mpa)
c. Flexural Strength: 21,000 PSI (145 Mpa)
d. Flexural Strength at 130 degrees C: 12,900 PSI (89 Mpa)
e. Compressive Strength: 32,500 PSI (224 Mpa)
f. IZOD Impact Strength (Notched): 8.4 Ft Lb/in (4.5 J/cm)
4. Flame and Smoke Characteristics
a. Flame retardant, self-extinguishing, with a flame spread rating of 25 or less in accordance with ASTM-E84
b. Oxygen Index: 35%
c. Smoke Density: 115
5. Physical Properties
a. Water Absorption: 0.4%
b. Specific Gravity: 4.81
c. Coefficient of Thermal Expansion: 2 In/in/ degree C x 10^-5

d. Thermal Conductivity: 1.9 BTU/Hr/Ft^2/In/degree F

6. Chemical Resistance
   a. Splash and Spill Resistance:
      1) Suspend sample panel in a vertical plane
      2) Apply five drops of each reagent listed with an eyedropper
      3) Apply liquid reagents at top of panel and allow to flow down full panel height
   b. Fume Resistance:
      1) Place 25 milliliters of reagent into 100 milliliters beakers and position panel over beaker tops in the proper sequence. Ensure beaker pouring lip permits air to enter the interior atmosphere.
      2) After 24 hours remove panel, flush with water, clean with detergent, rinse, wipe dry and evaluate
   c. Evaluation ratings: Change in surface finish and function shall be described by the following numerical ratings
      1) No Effect: No change in color or gloss
      2) Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material
      3) Good: Clearly discernible change in color or gloss, but no significant impairment of function or life
      4) Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period
      5) Failure: Pitting, cratering or erosion of work surface material; obvious and significant deterioration
   d. Required minimum results for each reagent (Reagent: Fume Resistance Rating, Splash and Spill Resistance Rating)
      1) Hydrochloric Acid (37%): 2,1
      2) Sulfuric Acid (33%): 2,1
      3) Sulfuric Acid (77%): 1,1
      4) Sulfuric Acid (96%): 1,2
      5) Formic Acid (90%): 2,1
      6) Nitric Acid (20%): 2,2
      7) Nitric Acid (30%): 1,2
      8) Nitric Acid (70%): 3,2
      9) Hydrofluoric Acid (48%): 2,2
      10) Phosphoric Acid (85%): 1,1
      11) Chromic Acid (60%): 1,4
      12) Acetic Acid (98%): 1,1
      13) Ammonium Hydroxide (20%): 1,1
      14) Sodium Hydroxide (10%): 1,1
      15) Sodium Hydroxide (20%): 1,3
      16) Sodium Hydroxide (40%): 1,3
      17) Sodium Hydroxide Flake: 1,-
      18) Sodium Sulfide: 1,1
      19) Zinc Chloride: 2,1
      20) Tincture of Iodine: 3,3
      21) Silver Nitrate: 2,1
      22) Methyl Alcohol: 1,1
      23) Ethyl Alcohol: 1,1
      24) Butyl Alcohol: 1,1
      25) Benzene: 1,1
      26) Xylene: 1,1
      27) Toluene: 1,1
      28) Gasoline: 1,1

29)	Dichloro Acetic Acid:	2,2
30)	Dimethyl Formanide:	2,2
31)	Ethyl Acetate:	1,1
32)	Amyl Acetate:	1,1
33)	Acetone:	1,1
34)	Chloroform:	1,1
35)	Carbon Tetrachloride:	1,1
36)	Phenol:	2,2
37)	Cresol:	1,1
38)	Formaldehyde:	1,1
39)	Trichloroethylene:	1,1
40)	Ethyl Ether:	1,1
41)	Furfural:	1,3
42)	Methylene Chloride:	1,1
43)	Mono Chloro Benzene:	1,1
44)	Dioxane:	1,1
45)	Methyl Ethyl Ketone:	1,1
46)	Acid Dichromate:	1,2
47)	Hydrogen Peroxide:	1,1
48)	Napthalene:	1,1

B. Sheet Steel
1. Side panels and access panels 20-gauge (or heavier) sheet steel.
2. Hood corner posts are 16-gauge sheet steel.
3. Ceiling enclosure panels are 18 gauge sheet steel.
4. Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M.

C. Chemical Resistant Finish
1. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling.
2. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Third party validation required.
3. Powder-coat process required. Paint processes that release Volatile Organic Compounds (VOC) are not acceptable
4. Color for Fume Hood Finish:
   a. As selected by Architect from Manufacturer’s full range.
   b. Custom color to match lab casework painted finish.

D. Safety Glass
1. Tempered
   a. Clarity and temper test to be as specified in latest edition of Glass Tempering Association, Engineering Standards Manual, Section 8.1.
   b. Surface and interior visible quality to be as specified per ASTM C 1036, Standard Specification for Flat Glass, Table 4, Quality level Q3.

2.4 CONSTRUCTION

A. Superstructure:
1. Self-supporting, rigid structural assembly, to support inner wall consisting of fume hood liner and outer wall of sheet metal exterior.

2. Fabricated from galvanized steel.
3. Space shall accommodate fume hood wiring and plumbing components for service fixtures.
4. Access to fixture valves concealed in wall provided by exterior removable access panels, gasket access panels on the inside liner walls, or through removable access panels on the front posts.

B. Exterior
1. Fabricate from steel sheet with component parts screwed together.
2. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.
3. Interchangeable side panels shall lift off without the use of tools to allow access to plumbing lines, service fittings, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and Velcro type fasteners, are not acceptable.
4. Corner posts
   a. Pre-punched and plugged to accommodate up to 4 service fixtures per side
   b. All services are accessible from the front of the hood.
   c. Aerodynamic shape
   d. Accommodate two electrical duplexes per side.
   e. Right hand corner post includes electrical switches and pre-cut for Airflow monitor installation.
   f. Un-used penetrations shall be plugged.
5. Top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
6. Panel above header shall be removable without the use of tools to allow access to mechanical connection, electrical wiring, counterbalance sash weights, and light fixtures. Exposed fasteners or hardware, and “hook-and-loop” type fasteners, are not acceptable.

C. Dimensions
1. The hood’s exterior dimensions noted on the drawings for width, and depth are nominal and shall not be exceeded.
2. The hood’s height shall be no higher than 59” for all configurations.
3. The hood’s interior height shall not be less than 48”.
4. The hood’s interior width shall be reduced by no less than 12” from the nominal width. The hood’s Interior depth shall be reduced by no less than 8 ½” from the nominal depth.

D. Hood Liner
1. Adhere interior liner components to superstructure.
2. Stainless steel fasteners shall be used on the interior ceiling for structural integrity.
3. Fasteners exposed to chemical environment are not acceptable.
4. Punch fume hood lining side panels to receive four service fittings, for use with remote controls, per side. Provide removable plug buttons for holes not used for indicated fittings.
5. Each side wall shall include an oval interior access panel to provide access to the side wall of the fume hood for plumbing service access. Access panel material shall be that of the liner, and gasketed to form a vapor proof seal.

E. Hood Baffle
1. Baffle system shall be designed to optimize the face velocity profile, and to capture a wide range of gaseous densities without adjustment or moving components.

2. Shall provide a continuous horizontal slot at the work surface. Baffle panels shall have multiple horizontal slots, with a chamfered entry. Slot pattern shall be proven to optimize face velocity profile.
3. The baffle system shall be constructed with the same material as the fume hood liner.
4. The baffles shall be removable for cleaning. The primary baffles shall be three pieces to allow removal without the use of tools.
5. Exposed components to be non-metallic. Metal components exposed to chemical environment are not acceptable.
6. Moving parts or adjustment of any kind is not acceptable.

F. Exhaust Connection
1. 316 stainless steel with Chemical-Resistant Finish
2. 12.81" ID to accommodate any 12” nominal duct without the need for a transition adapter. 3, 4, 5, and 6-foot hoods have one exhaust connection, 7 and 8-foot hoods have two exhaust connections. Additional components required to accommodate 12” nominal mechanical system are not acceptable.
3. Ducting shall go inside the duct collar to ensure condensate travels into the hood and evaporates. Duct collars that allow duct connection over the collar are not acceptable.

G. Airfoil
1. 316 stainless steel with Chemical-Resistant Finish.
2. Airfoil shall have an aerodynamic radius to sweep the air into the hood with minimal turbulence. Airfoil directs airflow across work top to remove heavier-than-air gases.
3. Airfoil shall have no fewer than 5 rows of perforations to allow the air to bypass underneath and through the foil and sweep across the work surface to prevent any back flow of fumes escaping from the front of the hood opening. The airfoil must be designed to maintain airflow even if blocked by the presence of an operator.
4. Foil must extend back under the sash to prevent closure of the lower by-pass opening when the sash is in the fully closed position, directly on top of the airfoil.

H. Sash Assembly
1. Glass: Fully tempered safety glass with unobstructed, side-to-side view of fume hood interior and service fixture connections.
2. Dimensions: The full sash opening height is 28", the total unobstructed viewing height is 37.5" measured from the work surface.
3. Sash Tracks: Steel with Chemical Resistant Finish. Shall include bump stops for opening and closing.
4. Sash Handle: extruded aluminum with Chemcial Resistant Finish. Sash handle includes a perforated air passage directly atop the handle to bleed air into the hood chamber and direct chemical fumes away from the user's breathing zone. The handle is ergonomic in design and is easy to grasp when operating
5. Sash guides: Corrosion resistant extruded poly-vinyl chloride.
6. Sash System
    a. Vertical Sash (Chain and Sprocket)
        1) Hoods have a single vertical sash counterbalanced by a single weight.
        2) Sash and weight to be connected via #35 chains.
        3) Rear sprockets shall be connected via timing shaft to prevent sash tilting and permit one finger operation at any point along full width sash handle. Maximum 7 pounds pull required to raise or lower sash throughout its full length of travel.
        4) Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure.

5) Include a defeatable, and automatically resetting sash stop positioned for an 18” sash height.

I. Electrical Components (for non-explosion proof hoods)
1. Lighting
a. Provide UL Listed, high-efficiency, quick-start, T8 fluorescent lighting systems, including bulbs.
1) 3 Foot Hoods - 2 each, 2-foot 17-watt fluorescent lamps
2) 4 Foot Hoods - 2 each, 3-foot 25-watt fluorescent lamps
3) 5 Foot Hoods - 2 each, 4-foot 32-watt fluorescent lamps
4) 6 Foot Hoods - 2 each, 4-foot 32-watt fluorescent lamps
5) 7 Foot Hoods - 2 each, 4-foot 32-watt fluorescent lamps
6) 8 Foot Hoods - 4 each, 3-foot 25-watt fluorescent lamps
b. Vapor-Proof: all electrical components shall be outside of the contaminated air space. Lighting shall be located behind a laminated safety glass shield, sealed to the top of the hood liner.
c. The fluorescent light assemblies shall be serviceable from outside the fume hood cavity, without the use of tools.
d. Light switch to be included on the lower right corner post, at heights compliant with the Americans with Disabilities Act (ADA).
2. Blower Switch
a. Hoods configured as the only hood on an exhaust system, shall be provided with an on off blower switch on the lower right corner post and at a height compliant with the Americans with Disabilities Act (ADA).
3. Electrical Receptacles
a. The hoods shall be designed to accommodate up to four (two per corner post) electrical receptacles.
b. Provide receptacle types where indicated on the drawings:
1) 115 volt, 60 Hz, three-wire polarized and grounded electrical duplex
2) 115 volt, 60 Hz, three-wire polarized and grounded electrical duplex, with Ground Fault Circuit Interruption (GFCI)
3) 230volt, 60 Hz, three-wire polarized and grounded electrical duplex
c. Receptacles shall be individually wired to field wiring box, and each rated at 20 Amperes.
d. Cover plates shall be acid resistant thermoplastic.
4. Wiring
a. Every electrical component shall be individually wired to a single point internal field wiring box (including individual duplexes/receptacles).
b. Field wiring box to be 7” x 4” x 2.5”, grounded, and have (12) 7/8” diameter knock out penetrations.
c. Final wiring and circuit dedication is to be by others.
d. Each receptacle circuit shall accommodate being wired to a dedicated building circuit rated at 20A, or the receptacles ganged together on a building circuit with the total load not exceeding 20 Amperes.
5. Fume hood to have third party validation of compliance to UL 1805 and UL 61010-1 by a Nationally Recognized Testing Laboratory (NRTL)

J. Electrical Requirements for Hoods indicated to be Explosion Proof :
1. Hoods shall be EP rated, by the manufacturer and tested for use in a space electrically classified as an explosion hazard per NFPA 70
2. Lighting: UL listed, EP rated incandescent light fixtures
3. Wiring:

a. No wiring or switches are to be provided.
b. Hoods to be field wired to meet local codes for electrical equipment in a classified space having a potentially explosive atmosphere.

K. By-Pass Opening :
1. When a constant velocity hood is indicated: The size of the by-pass opening shall be controlled by the sash position. The hood shall not have a change in static pressure or exhaust volume across all sash positions.
2. When a VAV hood is indicated: The bypass opening shall be adjusted by the factory so that's it's position is fixed to block air flow.

L. Hood Safety Practices Label: Corrosion resistant plate attached to the left corner post of the fume hood with the following Hood Safety Practices:
1. For use with substances that produce hazardous levels of airborne chemicals: gas, fumes, vapors, dust
2. Do not put your head in the hood.
3. Minimize drafts and sudden movements in front of the hood.
4. Work a minimum of six inches inside the hood.
5. Elevate equipment above the work surface.
6. Keep sill and baffle unobstructed.
7. Do not use the hood for storage.
8. Adjust the sash to smallest opening possible when in use.
9. Close sash when unattended.
10. Do not remove any of the hood components.
11. Do not place flammable solvents near heat, flame or sparks.
12. Do not evaporate large amounts of flammable liquids.
13. Wipe up spills immediately.
14. Routinely validate airflow.
15. If the ventilation system malfunctions, or airflow alarm indicates unsafe condition, close sash and discontinue hood operation immediately-call for help.
16. Do not use with Biohazards or Perchloric Acid

M. Fume Hood Accessories
1. Service Fixtures: Color-coded hose nozzle outlets and valves mounted inside the fume hood and controlled from the exterior with color-coded index handles.
a. The hoods are to be equipped with service fixture knockouts on the exterior and interior panels for up a total of up to 8 service fixtures.
b. The hoods are to be factory equipped with service fixtures as indicated in schedule located on the drawings as follows:
1) Hose connectors located inside the fume hood cavity are chemically-resistant, glass-filled polypropylene with 6 serrations.
2) Service lines shall be factory installed from valve to outlet.
a) Copper tubing unless otherwise noted
b) Brass service lines for gas
c) Stainless steel service lines for Deionized Water
d) Connections shall be made with quick-connect compression fittings on the inlet and outlet of the valve body, soldered and brazed connections not easily disassembled are not acceptable.
e) Services are to be pre-piped to the top of the hood shroud unless otherwise noted on the drawings.
3) Valves

a) Extruded brass valve and rotating seat, TFE-coated silicone bronze stem and TFE packing.
b) Fixture handles are plastic and color coded as well as labeled for the designated type of service.
c) Fixtures are rated at maximum pressure of 200 psi.
d) Coefficient of flow for the valve, Cv=0.43.
e) Valves are front loaded, located on the fume hood corner post for remote use, and include:
f) Hot and cold tap water
g) Natural gas
h) Air
i) Vacuum
j) Nitrogen
k) Argon
l) Steam
m) Oxygen (include oxygen compatible lubricant)
n) Deionized/Distilled water (Nickel plated and stainless steel components)

2. Tissue Screen: Provide epoxy-coated, stainless-steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.
3. Rear Finish Panel: Shall be the same materials and coating as the hood exterior.
4. Ceiling Enclosure Panels:
   a. When finished ceilings are present adjacent to the hood, provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to 4 inches above the ceiling.
   b. Exposed fasteners are not acceptable.
5. Distillation Grid: If indicated on the drawings, include stainless steel rods and connectors for field assembly, and factory drilled liner.
6. Fire Suppression System: If fire suppression is indicated on the drawings provide an ABC dry powder fire suppression system, with 165 degree Fahrenheit fusible link, shall be factory supplied and prepped, and field installed through the ceiling of the fume hood.
7. Face Velocity Monitor/Alarm
   a. Shall not be included on Explosion Proof hoods
   b. Digital Airflow Monitor
      1) Provide audible and visual alarm in the event of an unsafe face velocity.
      2) Alarm must sit flush with the fume hood corner post.
      3) Based on a thermally compensated thermistor in the alarm module, and air passing through a separate airstream into the hood interior.
      4) Velocity shall be displayed digitally on the user facing LCD in fpm or m/s.
      5) LED lights display red for alarm, yellow for caution, and green for normal operation.
      6) Must include external alarm and night setback functions.
      7) Alarm mute shall be accessible from the front of the monitor; visual alarm must remain activated until alarm condition is corrected.
      8) UL Listed electrical components
      9) Calibration shall be through a menu driven step by step procedure.
      10) Calibration is the responsibility of the owner, following a complete balancing of the mechanical system, and concurrently with As-Installed testing.
   c. Audio/Visual Airflow Monitor
      1) Provide audible and visual alarm in the event of an unsafe face velocity.
      2) Alarm must sit flush with the fume hood corner post.

3) Based on a thermally compensated thermistor in the alarm module, and air passing through a separate airstream into the hood interior.
4) LED lights display red for alarm and green for normal operation.
5) Must include external alarm and night setback functions.
6) Alarm mute shall be accessible from the front of the monitor; visual alarm must remain activated until alarm condition is corrected.
7) UL Listed electrical components
8) Calibration shall be through a front located potentiometer.
9) Calibration is the responsibility of the owner, following a complete balancing of the mechanical system, and concurrently with As-Installed testing.

d. Variable Air Volume (VAV): Coordinate with the HVAC system requirements :
1) Fume hoods shall be factory prepared with the proper cutouts and brackets to field mount specified VAV controller and sash position sensor specified.

N. Work Surface
1. 1.25” thick, molded from solid modified epoxy resin, with smooth, non-specular, color to match lab countertops.
2. One inch radius front edge for optimal fume hood performance.
3. 3/8” dished area to match the fume hood interior work space and form a water tight pan for spill containment.
4. Include a 2.5” diameter hole on each side for service pass-through and piping. Hole to be covered by hood superstructure upon installation.
5. Include two 1.5” diameter penetrations to accommodate base cabinet venting. Holes to be located outside of dished area and under the fume hood baffles. Include plugs.
6. Physical Properties:
a. Flexural Strength: Not less than 10,000 psi (70 MPa).
b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
c. Hardness (Rockwell M): Not less than 100.
d. Water Absorption (24 Hours): Not more than 0.02 percent.
e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
f. Flame-Spread Index: 25 or less per ASTM E 84.
7. Cupsink
a. 3 x 6” dimension, polypropylene construction
b. Provide with strainers and tailpieces, NPS 1-1/2 (DN 40)
c. To sit flush with dished area of work surface
d. Cupsinks are to be located as detailed ion the drawings.

O. Supporting Base Cabinets
1. Base cabinets shall be in depths of 22", widths, quantities, and types required to support the full width of the specified hood called out in the equipment schedule or drawings, and meet the requirements of this specification.
2. Provide adjustable bases where indicated on the drawings.
3. Construction requirements for all cabinets
a. Exterior construction is 18 gauge (or heavier) cold rolled sheet steel with Chemical Resistant Finish.
b. Hinges are 10 gauge (or heavier) plate with self-clinching pilot pin. Knuckle, bullet, or piano type hinges are not accepted.
c. The rear panel will feature a 12" x 8" removable plumbing access panel.
d. Units 24" wide or less have only one door.
e. Each cabinet includes four leveling feet.
f. Capable of supporting up to 800 pounds.
g. A filler panel is required to increases the cabinet depth to work surface depth.

4. Standard Storage (when no designations are indicated on the doors)
    a. Overall exterior dimensions:
        1) Width as indicated on the drawings with height as required to match adjacent casework height.
        2) If cabinet is indicated to be HC accessible the height shall be in a range of 31 1/2 inches to 32.3/4 inches.
    b. Pulls handles to match size and finish of adjacent casework.
5. Acid Storage
    a. Overall exterior dimensions:
        1) Width as indicated on the drawings with height as required to match adjacent casework height.
        2) If cabinet is indicated to be HC accessible the height shall be in a range of 31 1/2 inches to 32.3/4 inches.
    b. Pulls handles to match size and finish of adjacent casework.
    c. Completely lined with a polyethylene corrosion resistant liner. The liner is 3/16" thick, with a vacuum formed PVC liner pan at the bottom to contain spills. Each door has a 3/16" sheet polyethylene liner.
    d. The cabinet is labeled: "ACID".
    e. Each cabinet is vented into the fume hood with a 1-1/2" vent pipe. It should provide a positive airflow directly into the fume hood exhaust system.
    f. Supply an epoxy coated steel shelf with PVC liner pan if indicated in the schedule.
    g. Acid cabinets with louvers are not acceptable
6. Solvent/Fammable Storage
    a. Overall exterior dimensions:
        1) Width as indicated on the drawings with height as required to match adjacent casework height.
        2) If cabinet is indicated to be HC accessible the height shall be in a range of 31 1/2 inches to 32.3/4 inches.
    b. Pulls handles to match size and finish of adjacent casework.
    c. Solvent storage cabinets are specifically designed for the storage of flammable and combustible liquids.
    d. Solvent Storage Cabinet must be compliant with NFPA 30 “Flammability and Combustible Liquids Code.”
    e. Cabinets 30" wide and greater shall be tested and approved by Factory Mutual to meet Factory Mutual Approval Standard 6050.
    f. The bottoms, top, sides, and doors are fabricated of 18 gauge steel and are all double panel construction with a 1-1/2" air space between panels.
    g. All joints are welded or screwed to provide a rigid enclosure. A 2" deep liquid tight pan that covers the entire bottom of the cabinet is furnished to contain liquid leaks and spills.
    h. A full-depth, 18 gauge steel, adjustable shelf is also provided. Shelves are sealed leak tight.
    i. Two diametrically opposed flame arrestor vents with spark screens are provided in the back of the cabinet, as well as a grounding screw.
    j. The cabinet has an interior finish same as the exterior.
    k. The cabinet is labeled: "FLAMMABLE - KEEP FIRE AWAY".
    l. The right hand door shall have a three point latching device.
    m. Door handles include a key lock. Solvent storage handles are locking lever handles with bright chrome finish.
    n. If noted on the schedule, self-closing/self-latching models shall be provided with a fusible-link feature to ensure the doors will close if the temperature outside the cabinet exceeds 165 degrees Fahrenheit. The doors are synchronized so that both doors will fully close.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.

B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in and for rough opening dimensions required for the installation of the hood.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fume hoods according to shop drawings and manufacturer's written instructions.

B. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework.

C. 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.

D. Neighboring splash blocks shall not be attached directly to the hood.

E. Install according to standards required by authority having jurisdiction.

F. Sequence installations to ensure utility connections are achieved in an orderly and expeditious manner.

G. Touch up minor damaged surfaces caused by installation. Replace damaged components as directed by Architect.

3.3 FIELD QUALITY CONTROL

A. Field test installed fume hoods according to ASHRAE 110 to verify compliance with performance requirements.
   1. Adjust fume hoods, hood exhaust fans, building's HVAC system, and make other corrections until tested hoods perform as specified in fume hood schedule.
   2. After making corrections, retest fume hoods that failed to perform as specified.

3.4 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. Clean adjacent construction and surfaces that may have been soiled in the course of installation of work in this section.

D. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.

E. Advise contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

END OF SECTION 115313.10

SECTION 122200 - CURTAINS AND DRAPES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Blackout curtains.

B. Curtain tracks.

1.02 SUBMITTALS

A. Product Data: For the following:

1. Drapery Tracks: Include maximum weights of drapes that can be supported.
2. Fabrics.
3. Textile treatments.

B. Shop Drawings:

1. Drapery Tracks: Show installation and anchorage details.
2. Drapes: Show sizes, locations, and details of installation.

C. Product Schedule: For drapes and drapery tracks. Use same designations indicated on Drawings.

D. Coordination Drawings: For drapery track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items, on which the following items are shown:

1. Suspended ceiling components.

E. Product Certificates: For each drapery fabric treated with flame retardant, signed by fabric supplier and indicating treatment durability and cleaning procedures required to maintain treatment effectiveness.

F. Maintenance Data: For products installed to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: For drapes and drapery tracks, fabricator of drapes.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before drape fabrication, and indicate measurements on Shop Drawings.

B. Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

A. Manually Operated Track:

1. Basis-of-Design Product: 80/20 Aluminum T-Slot Building Systems.
2. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 incheso.c.

    a. Lengths and Configurations: As indicated on Drawings.
    b. Finish: Manufacturer's standard.

3. Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction.
4. Operation: Baton.

    a. Draw: One way, stack as indicated on Drawings.

5. Carriers: Coordinate with drapery headings indicated.
6. End Stops: Manufacturer's standard.

2.2 DRAPES

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. BlackoutCurtains.com; Laboratory Blackout Curtains.
2. Brite Inc. Blackout Curtains.
3. Edmund Optics; Blackout Curtains.
4. ThorLabs; Blackout Curtain System.

B. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.

C. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. Curtains:

1. Curtain Fullness: Sewn flat with 15 percent fullness.
2. Curtain Top: Provide grommets at 6 inches on center.
3. Drapery Fabric: Blackout.
4. Textile Treatments: Stain repellent; and flame retardant, polymer type.
5. Valance: Provide manufacturer's matching fabric 12-inch minimum high valance. Provide manufacturer's sewn-on Velcro strip attachment to track face.

2.3 DRAPE FABRICATION

A. Fabricate drapes in heading styles and fullness indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

1. One-Way-Stacking Drapes: Add 5 inchesto overall width for returns.
2. Double Curtains: Overlap approximately 24 inches where separate curtain panels meet.

B. Bottom Hems: Double-turned, 2-inch-wide hems consisting of three layers of fabric, and weighted and blind stitched so that weights and stitches are invisible on face of drape.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPE INSTALLATION

A. Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch.

B. Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.

3.3 ADJUSTING

A. After hanging drapes, test and adjust each drapery track to produce unencumbered, smooth operation.

B. Steam and dress down drapes as required to produce crease- and wrinkle-free installation.

C. Remove and replace drapes that are stained or soiled.

END OF SECTION 122200

SECTION 123553.13 - METAL LABORATORY CASEWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Section Includes:

1. Metal laboratory casework.
2. Mobile cabinets.
3. Laboratory Tables.
4. Wall shelving.
5. Adaptable laboratory casework system.
6. Acid storage cabinets.
7. Solvent storage cabinets.
8. Ceiling service panels.
9. Laboratory countertops.
10. Laboratory sinks.
11. Laboratory accessories.
12. Laboratory emergency equipment plumbing fixtures.
13. Water, laboratory gas, and electrical service fittings.

B. RELATED REQUIREMENTS

1. Section 079200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
2. Section 092116 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework.
3. Section 096500 - Resilient Flooring: Resilient wall base.
4. Section 115313 - Laboratory Fume Hoods
5. Section 224000 - Plumbing Fixtures: Non-laboratory sinks.
6. Division 22: Furnishing and installation of piping drain line, traps, final connections and setting of sinks and fixtures.
7. Division 23: Furnishing and installation of exhaust ductwork, transition(s), blowers and equipment, and final connection to fume hood(s).
8. Division 26: Furnishing and installation of electrical wiring, conduit and/or electrical items and final connections.

1.02 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.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

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 C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017 (Reapproved 2021).

G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. BHMA A156.9 - Cabinet Hardware; 2020.

J. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 1 - Fire Code; 2024.

L. NFPA 30 - Flammable and Combustible Liquids Code; 2024.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. SEFA 1 - Laboratory Fume Hoods; 2010.

O. SEFA 2 - Installations; 2010.

P. SEFA 3 - Laboratory Work Surfaces; 2020.

Q. SEFA 7 - Laboratory Fixtures; 2021.

R. SEFA 8M - Laboratory Grade Metal Casework; 2020.

S. SEFA 10 - Adaptable Laboratory Furniture Systems; 2013.

T. SEFA 11 - Liquid Chemical Storage Cabinets; 2019.

1.04 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.
3. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

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.

C. Scope includes:

1. Modular component lab casework system used to create work space and storage assemblies. Furnish cabinets and casework, including tops, ledges, supporting structures, nd miscellaneous items equipment as listed in these specifications, or equipment schedules, including delivery to the building, setting in place, leveling, scribing to walls and floors as required. Furnishing and installing all filler panels, knee space panels and scribes as shown on drawings.
2. Furnishing and delivering all utility service outlet accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings as mounted on the laboratory furniture. The above-defined items shall be furnished with supply tank nipples and lock nuts, loose in boxes and properly marked. All plumbing and electrical fittings will be packaged separately and properly marked for delivery to the appropriate contractor.
3. Furnishing and delivering, packed in boxes for installation by the mechanical contractor, all laboratory sinks, cup sinks or drains, drain troughs, overflows and sink outlets with integral tailpieces, which occur above the floor, and where these items are part of the equipment or listed in the specifications, equipment schedules or shown on the drawings. Integral tailpieces when required shall be in accordance with the manufacturer's standards. All tailpieces shall be furnished less the couplings required to connect them to the drain piping system.
4. Furnishing service strip supports where specified, and setting in place service tunnels, service turrets, supporting structures and reagent racks of the type shown on the details.

1.05 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.

1. Flammable Liquid and Hazardous Material Storage Cabinets: Show compliance with specified reference standards, testing by recognized agencies, and application of testing labels.

C. Shop Drawings: For laboratory casework.

1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
2. Indicate types and sizes of casework.
3. Indicate manufacturer's catalog numbers for casework.
4. Show fabrication details, including types and locations of hardware.
5. Indicate locations and types of service fittings.
6. Include details of utility spaces showing supports for conduits and piping.
7. Include details of support framing system.
8. Include details of exposed conduits, if required, for service fittings.
9. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and laboratory equipment.
10. Include coordinated dimensions for laboratory equipment specified in other Sections.

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. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Maintenance Data: Manufacturer's recommendations for care and cleaning.

J. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

A. Single source: Casework to be manufactured and furnished by a single laboratory furniture company. Installer certified by the manufacturer.

B. Casework Manufacturer Qualifications: Modern plant with proper tools, dies, fixtures and skilled production staff to produce high quality laboratory casework and fume hoods, and shall meet the following minimum requirements:

1. Minimum of ten years experience in manufacture of metal laboratory casework and fume hoods.
2. A list of ten (10) installations of comparable stature completed by their workforce within the past 5 years and that has been tested for compliance with SEFA 8.

C. Installer Qualifications: Engage an experienced installer to perform work of this Section who has completed installations similar in design and extent to that indicated for this Project, and who has a record of successful in-service performance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver laboratory casework and work surfaces to job site only after wet operations in construction site are completed and proper facilities are available for handling, storage and protection. Use blanket wrap reusable packing for delivery.

B. Proper precautions must be taken to minimize temperature, moisture, and impact issues during shipment to site.

C. Store laboratory casework in a ventilated area, protected from the weather, with relative humidity of 50% + or – 15% and not to be lower than 25% at 60-80 degrees F.

D. Replacements: In the event of damage immediately replace.

E. Casework: Protect finished surfaces from soiling or damage during handling and installation.

F. Work surfaces: Protect throughout the construction period with protective covering of polyethylene film or other suitable material.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet-work are complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Established Dimensions: Where laboratory casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C. Field Measurements: Where laboratory casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year warranty covering the work of this section against defects or non-conforming materials and/or workmanship. 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.
6. Slippage, shifts, or failures of connected components, including attachments to wall, floor, ceiling, or building structure.
7. Warping or unloaded deflection of components.

1.10 COORDINATION

A. All cabinets shall be manufactured, sorted, delivered, and installed as complete elevations within each lab.

B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

C. Coordinate layout and installation with other work, including light fixtures, fixed equipment and workstations, HVAC equipment, fire-suppression system components.

D. Coordinate location and requirements of service-utility connections.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. System Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8M, laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft.
2. Work Surfaces: 200 lb/ft.
3. Wall Cabinets (Upper Cabinets): 160 lb/ft.
4. Shelves: 60 lb/sq. ft.

2.02 MANUFACTURERS

A. The intent of this specification is to define a level of craftsmanship necessary to provide, for the owner and architect, a well-designed and quality system of laboratory casework. Only materials and/or products that are in accordance with the requirements will be acceptable. Bidders who propose to provide any product which deviates from the standards listed herein must describe, in writing, the instances in which the equipment differs from the specifications, and must obtain, from the architect, written approval to bid an alternate/substitution a minimum of 10 days prior to the bid date. Any bid that fails to be expressed as an alternate/substitution will be interpreted as an offer to design, construct and provide products based on the specifications outlined in this text.

B. Design, materials, construction and finish of casework as specified represents the minimum acceptable standard of quality as indicated but not limited for laboratory casework, table frames, adjustable tables, special purpose storage cabinets, shelving, reagent racks, fittings, sinks, drains and traps and accessories.

C. Subject to compliance with these requirements, the manufacturers listed within are acceptable to perform this section of work. Although listed herein, the citing of the listed manufacturers does not in any way relieve them of their obligation to build the laboratory casework, furniture, and equipment in strict accordance with the specifications and construction documents.

1. General Note: Where manufacturer is not indicated, Lab Casework/Equipment Contractor shall provide manufactured products based on design intent as shown on drawings. Final approval by Architect.

D. Laboratory Casework Basis of Design Manufacturer: Subject to compliance with requirements, provide products by Kewaunee Scientific Corp., or comparable products by one of the following indicated below:

1. Bedcolab Ltd: www.bedcolab.com/#sle.
2. Institutional Casework Inc: www.iciscientific.com/#sle.
3. Labcrafters, Inc: www.lab-crafters.com/#sle.
4. Mott Manufacturing Ltd: www.mott.ca/#sle.

E. Countertops:

1. Durcon (Epoxy Resin): www.durcon.com/#sle.
2. Kewaunee Scientific Corp (Epoxy Resin): www.kewaunee.com/#sle.

F. Sinks and Cup Sinks:

1. Durcon (Epoxy resin, Polyolefin): www.durcon.com/#sle.
2. Kewaunee Scientific Corp (Epoxy Resin): www.kewaunee.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

G. Water and Gas Service Fittings:

1. Chicago Faucets, a Geberit company: www.chicagofaucets.com/#sle.
2. WaterSaver Faucet Co: www.wsflab.com/#sle.

H. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.03 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: Inset - square edge.
2. Primary Cabinet Material: Cold-rolled steel.

3. 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: 22 inch.
   b. Tall Cabinets: 16 inch.
   c. Upper Cabinets: 13 inch.
4. Steel Sheet Metal:
   a. Gables, Front and Back Panels, Gusset Plates, Aprons, and Rails: 18 gauge, 0.0478 inch minimum thickness.
   b. Drawers, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 20 gauge, 0.0359 inch minimum thickness.
   c. Backing Sheet to Door and Door Fronts: 22 gauge, 0.0299 inch minimum thickness.
5. 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. Base Units: 500 pounds per linear foot across the cabinet ends.
6. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
7. Edges and Seams: Smooth. Form counter tops and shelves from continuous sheets.
8. Shelf Edges: Turned down 3/4 inch on each side and returned 3/4 inch front and back.
9. Ends: Close open ends with matching construction.
10. Welding: Electric spot welded; joints ground smooth and flush.
11. 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.
12. Shelves: Adjustable and fixed shelves formed down 3/4 inch, returned back 7/8 inch, and up 1/4 inch into a channel shape, front and rear; formed down 3/4 inch at each end. Shelves over 42 inches long reinforced with a channel welded to underside of shelf.
13. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
14. Stainless Steel Finish: No.4, brushed finish.
15. 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 minimum steel channels to provide caster mounting points.
   b. Four casters, each with a load rating of 165 pounds.
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, 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. Cabinet is to be specifically designed for the storage of acids and bases.
3. Cabinet shall have clearly legible label describing its contents, silk screened directly to front face of door. Lettering shall be no less than 2 inches in height. Acid storage cabinets shall be labeled “ACID” in blue lettering. Base storage cabinets shall be labeled “BASE” in black lettering.
4. Shelves: Provide a full depth removable shelf of the same material as corrosion resistant liner. The removable shelf shall be polypropylene; perforated to allow vapors to reach the vent. Acid cabinet vents should be generally installed about 10" from the top. (A perforated shelf allows spills to be contained in the bottom pan).
5. Bottom Pan: Liquid tight, polypropylene liner covering entire bottom of acid storage cabinet.
6. Vents: Comply with SEFA 1.
    a. Locate acid storage cabinet vents in accordance with manufacturer's instructions.
    b. When acid storage cabinets are installed below fume hoods, provide louvered cabinet doors. Vent each cabinet through the hoodworksurface with a 1.5" corrosion resistant vent pipe. Vent pipe may be increased to a larger diameter, once pipe extends above fume hood, per Mechanical design.
    c. Vent base cabinets through work surface with manufacturer's vent kit.
    d. Vent each acid storage cabinet separately.
    e. Seal penetrations with chemical resistant sealant.

D. Solvent (Flammable and Combustible Liquids) Storage Cabinets:

1. Scope
    a. These requirements cover cabinets intended to be used to provide a storage area for limited quantities of flammable and combustible liquids in containers in compliance to ANSI/NFPA 30. Construction and performance requirements for cabinets are primary based on ANSI/NFPA 30.
    b. A storage cabinet may have a maximum total storage capacity of not more than 120 gallons (454 Liters) Class I, Class II and Class IIIA flammable and combustible liquids shall be stored in a storage cabinet. Of this total, not more than 60 gal. (227 liters) shall be of Class I and Class II liquids. Not more than three cabinets shall be permitted to be located in the same fire area. The maximum capacity rating is assigned by the manufacture.
2. Construction identical to other cabinets, with following exceptions:
    a. Cabinets shall be specifically designed for the storage of flammable and combustible liquids. Construct to NFPA 30 and applicable OSHA requirements.
    b. Comply with SEFA 11.
    c. Fire Resistance: Maximum internal temperature of 325 degrees F at the center, and 1 inch 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.
    d. Steel sheet, 18 gauge, 0.0478 inch minimum thickness, double panel construction with 1-1/2 inch space between panels and electrical grounding connection.
    e. Shelves: Full depth, adjustable sloped metal shelf.

f. Bottom Pan: 2 inches deep liquid-tight pan covering entire bottom of cabinet.
g. Cabinet Hardware: UL-listed.
1) Hinges: Full-length stainless steel continuous (piano) hinges.
2) Self-closing Doors: Comply with requirements of NFPA 1 and ICC (IFC). Minimum 90 degree opening. Three-point latch arrangement, door(s) shutting and latching automatically when hold-open device's fusible link melts at 165 degrees F under fire conditions outside the cabinet. At pair of doors, synchronize latching so that both doors always fully close.
3) Door Handles: Manufacturer's standard, with slip-resistant grip.
4) Grounding screw-lug.

3. 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 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.

4. Markings:
a. Provide manufacturer's standard signage reading "FLAMMABLE - KEEP FIRE AWAY" or similar message in letters not less than 2 inches high and in bright red color.
b. Each flammable liquid storage cabinet shall be marked with the company name or identification, the model or number designation, and cabinet capacity.
c. All markings shall be legible and durable. Markings shall be provided by stamping, by a metal name plate, by stenciling or painting, or equivalent.
d. If a manufacturer produces cabinets at more than one factory, each cabinet shall have a distinctive marking to identify it as a product of a particular factory.
e. FMRC Approval Sticker and UL Listing Sticker shall be clearly visible upon the top interior door panel. This sticker shall be a color contrasting to the background.
f. interior door panel. This sticker shall be a color contrasting to the background.

E. Tables: Include fixed and adjustable height units.

1. Fixed Height Table Construction: Manufacturer's standard, with manufacturer's standard material countertops, unless noted otherwise.
a. Formed metal skirting panels welded into a rigid frame. Corners notched and reinforced to receive manufacturer's standard square metal tubular legs, bolted securely in place.
b. Table Bracing: Removable tube members, in size standard with the manufacturer, installed between legs in manufacturer's standard configuration. Removable bracing designed to be mechanically fixed to concealed U-shaped mounting tabs that are integral with each leg.
c. 3/8 inch leveling devices.
d. Slip-on type black PVC shoes.
e. Mobile tables constructed the same as standard laboratory tables, except with table legs designed to receive swivel casters.
1) Caster wheels of nonmarring type urethane tires in gray or black color.

2. Adjustable Height Table Construction: Manufacturer's standard, with countertop worksurfaces, unless noted otherwise.
   a. Cantilevered Base Frame: Each base equipped with a pair of glides.
   b. Worksurface Support Frame: Telescoping from base frame.
   c. Worksurface: Manufacturer's standard material.
      1) Lift Capacity: 1,000 lb, evenly distributed on worksurface.
      2) Adjustability:
         (a) Total Range: 14 inches.
         (b) Manual Operation: Threaded fastener pins inserted into holes on 1 inch centers.
      3) Finish, Surface Color, and Texture: As indicated on drawings.

F. 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 spacing adjustments.
2. Shelves: 3/4 inch thick epoxy resin shelves in lengths indicated.
   a. Depth: 12 inches.

G. Ceiling Service Panels: Designed to integrate into Unistrut frame as shown on drawings for delivering multiple plumbing, electrical and data services.

1. Fabricated 24 inches by 24 inches.
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.

2.04 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. Comply with SEFA 10.

C. SEFA System Classification: Class 4 - Core based.

D. 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 vertical increments.

1. Island and Peninsula Modules: Designed to be supported directly on the floor or countertop.
   a. Width: 6 inches.
2. Module Length(s): 60 inches.
3. Module Height(s): 84 inches.

4. 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. Height of module to permit anchorage to supplementary structural bracing above ceiling.
   a. At Top: Mounting brackets or clip angles standard with the system manufacturer.

E. Facing Panels: End and insert closure panels at locations indicated on drawings.

1. Modular units, with tight fit to other system components. Panels to be removable and replaceable without use of special tools.
2. Unless otherwise indicated, facing closure panels of the following types:

F. Worksurface Frames and Countertops:

1. Core-based Frames: Shaped to allow cantilevering from structural modules and capable of supporting the weights of the countertop, suspended base cabinets, and imposed loads.
   a. Frame Length(s): 60 inches.
   b. Total Supportable Load: 600 pounds, 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.

G. Shelving: Modular units with integral brackets formed from metal sheets, with additional stiffener/reinforcing for units over 48 inch long.

H. Finishes:

1. Metal components: Same as other casework specified in this section.

2.05 CABINET HARDWARE

A. Manufacturer's standard styles, and as indicated below.

B. Comply with BHMA A156.9 requirements.

C. Finish of exposed stainless steel components: No.4 finish.

D. Locks: On casework drawers and doors, where indicated. Lock with 5 pin cylinder and 2 keys per lock.

1. Keying: Key locks alike within a space; key each room separately.
2. Master Key System: All locks operable by master key.

E. Label Holders: Manufacturer's standard, sized to hold standard label cards for drawer fronts and cabinet doors indicated, stainless steel with No.4 finish.

F. Shelves in Cabinets:

1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.

G. 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 wide.

H. Drawers:

1. Pulls: Brass wire pulls, 4 inches wide.
2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.06 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.
   b.
      1) Modulus of Elasticity: Not less than 2,000,000 psi (14000 MPa).
      2) Hardness (Rockwell M): Not less than 100.
      3) Water Absorption (24 Hours): Not more than 0.02 percent.
      4) Heat Distortion Point: Not less than 260 deg F (127 deg C).
   c. Flat Surface Thickness: 1 inch, nominal.
   d. Surface Finish: Smooth, non-glare.
   e. Color: Black.
   f. Exposed Edge Shape: 3/16 inch radius corner.
   g. Drip Edge: Drip groove 1/8 inch wide and deep, located 1/2 inch back from edge on underside of each exposed edge.
   h. Back and End Splashes: Same material, same thickness; separate for field attachment.

2.07 SINKS

A. Laboratory sinks.

1. General: Manufacturer's adjustable support system for undermount sink installation.

B. Non-laboratory sinks are identified on drawings and are specified in Section 224000.

2.08 LABORATORY EMERGENCY EQUIPMENT PLUMBING FIXTURES

A. General: Provide emergency equipment products complying with requirements of ANSI Z358.1.

B. Eyewash/Safety Shower Combination Units: Recessed into wall construction.

1. Cover/Eyewash Drain Pan: Combination fixture, with projecting activation handle requiring grasping and pulling down into operating position for activation.
   a. Plug-type valve designed to open orifice and activate water flow only when unit is swung down into operational position
   b. Twin eyewash heads mounted on supply arms, with internal flow control, and filter.
2. Shower Head: 10 inch diameter stainless steel, with 20 gallons per minute flow control.
   a. Mounting: Below finished ceiling. Include vertical supply pipe and ceiling escutcheon.
   b. Offset Dimension from Wall to Centerline of Head: 36 inches, barrier-free.
3. Cabinet: Designed for recess into 3-5/8 inch minimum depth metal-framed wall construction.
   a. Mounting: Mount at height complying with ADA Standards.
4. Activation Handle: Recessed into cabinet, projecting 1-7/8 inches maximum beyond face of wall, and requiring pushing down for activation.
   a. Grip: Manufacturer's standard vinyl grip.
5. Water Supply: 1 inch NPS FPT; 35 psi, minimum pressure.
6. Drain Outlet: 2 inch NPS FPT.
7.
8. Manufacturers:
   a. _____.

2.09 SERVICE FITTINGS

A. General: Comply with requirements of SEFA 7.

B. Gas Service Fittings and Fixtures.

1. Laboratory Gas Fitting Type: _____:
2. Vacuum Fitting Type: _____:

C. Water Service Fittings and Fixtures.

1. Pure Water Fitting Type: _____:

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.

E. Telecommunications: Manufacturer's standard complete fittings, in design compatible with electrical fittings.

1. Devices provided, and wired by Owner's separate contractor.

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.

2.11 FINISHES

A. Steel Paint System Finish and Performance Specification:

1. Steel Paint System Finish:
   a. After the component parts have been completely welded together and before finishing, they shall be given a pre paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.
   b. After the phosphate treatment, the steel shall be dried and all steel surfaces shall be coated with a chemical and corrosion resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.
   c. The completed finish system in standard colors shall meet the performance test requirements specified under PERFORMANCE TEST RESULTS.
2. Performance Test Results (Chemical Spot Tests):
   a. Testing Procedure:
      1) Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4" dia. watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2 ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

b. Test Evaluation:

1) Evaluation shall be based on the following rating system.

(a) Level 0 No detectable change.

(b) Level 1 Slight change in color or gloss.

(c) Level 2 Slight surface etching or severe staining.

(d) Level 3 Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

2) After testing, panel shall show no more than three (3) Level 3 conditions.

c. Test Reagents

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	Cotton ball & bottle
2.	Acetate, Ethyl	Cotton ball & bottle
3.	Acetic Acid, 98%	Watch glass
4.	Acetone	Cotton ball & bottle
5.	Acid Dichromate, 5%	Watch glass
6.	Alcohol, Butyl	Cotton ball & bottle
7.	Alcohol, Ethyl	Cotton ball & bottle
8.	Alcohol, Methyl	Cotton ball & bottle
9.	Ammonium Hydroxide, 28%	Watch glass
10.	Benzene	Cotton ball & bottle
11.	Carbon Tetrachloride	Cotton ball & bottle
12.	Chloroform	Cotton ball & bottle
13.	Chromic Acid, 60%	Watch glass
14.	Cresol	Cotton ball & bottle
15.	Dichlor Acetic Acid	Cotton ball & bottle
16.	Dimethylformanide	Cotton ball & bottle
17.	Dioxane	Cotton ball & bottle
18.	Ethyl Ether	Cotton ball & bottle
19.	Formaldehyde, 37%	Cotton ball & bottle
20.	Formic Acid, 90%	Watch glass
21.	Furfural	Cotton ball & bottle
22.	Gasoline	Cotton ball & bottle
23.	Hydrochloric Acid, 37%	Watch glass
24.	Hydrofluoric Acid, 48%	Watch glass
25.	Hydrogen Peroxide, 3%	Watch glass
26.	Iodine, Tincture of	Watch glass
27.	Methyl Ethyl Ketone	Cotton ball & bottle
28.	Methylene Cloride	Cotton ball & bottle
29.	Mono Chlorobenzene	Cotton ball & bottle
30.	Naphthalene	Cotton ball & bottle
31.	Nitric Acid, 20%	Watch glass
32.	Nitric Acid, 30%	Watch glass
33.	Nitric Acid, 70%	Watch glass
34.	Phenol, 90%	Cotton ball & bottle
35.	Phosphoric Acid, 85%	Watch glass
36.	Silver Nitrate, Saturated	Watch glass
37.	Sodium Hydroxide, 10%	Watch glass
38.	Sodium Hydroxide, 20%	Watch glass
39.	Sodium Hydroxide, 40%	Watch glass

40.	Sodium Hydroxide, Flake	Watch glass
41.	Sodium Sulfide, Saturated	Watch glass
42.	Sulfuric Acid, 33%	Watch glass
43.	Sulfuric Acid, 77%	Watch glass
44.	Sulfuric Acid, 96%	Watch glass
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46.	Toluene	Cotton ball & bottle
47.	Trichloroethylene	Cotton ball & bottle
48.	Xylene	Cotton ball & bottle
49.	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

d. Performance Test Results (Heat Resistance):
   1) Hot water (190° F - 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

e. Performance Test Results (Impact Resistance):
   1) A one-pound ball (approximately 2" diameter) shall be dropped from a distance of 12 inches onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye-ball examination.

f. Performance Test Results (Bending Test):
   1) An 18 gauge steel strip, finished as specified, when bent 180o over a 1/2" diameter mandrel, shall show no peeling or flaking off of the finish.

g. Performance Test Results (Adhesion):
   1) Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1/16" apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination. Note: This test is based on ASTM D2197 68, "Standard Method of Test for Adhesion of Organic Coatings".

h. Performance Test Results (Hardness):
   1) The test sample shall have a hardness of 4 H using the pencil hardness test. Pencils, regardless of their brand are valued in this way: 8 H is the hardest, and next in order of diminishing hardness are 7 H, 6 H, 5 H, 4 H, 3 H, 2 H, F, HB, B (soft), 2 B, 3 B, 4 B, 5 B (which is the softest).
   2) The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel like manner until one is found that will cut or scratch the film. The pencil used before that one that is, the hardest pencil that will not rupture the film is then used to express or designate the hardness.

2.12 ACCESSORIES

A. Gas Cylinder Brackets: Restraint safety assemblies for laboratory gas cylinders.

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. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. 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.

D. 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 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.
2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
    a. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 feet and 1/2 inch in 20 feet or more, and/or maximum variation from plumb exceeds 1/4 inch per story.
    b. Maximum variation of finished gypsum board surface from true flatness exceeds 1/8 inch in 10 feet in any direction.

E. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/16 inch in 10 feet .
3. Variation of Faces of Cabinets from a True Plane: 1/16 inch in 10 feet.

4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

G. Secure upper and floor cabinets to concealed reinforcement at gypsum board assemblies.

H. Separate dissimilar metals to prevent galvanic action.

I. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

J. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

K. 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.

L. Replace units that are damaged, including those that have damaged finishes.

M. Coordinate installation of work of this section with installation of fume hoods and laboratory equipment.

N. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

O. 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 123553.13

SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Countertops for manufactured casework.

C. Sinks molded into countertops.

D. Epoxy resin sinks.

1.02 RELATED REQUIREMENTS

A. Section 123553.13 - Metal Laboratory Casework: Laboratory countertops.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. AWI (QCP) - Quality Certification Program.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.

H. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material.

I. NEMA LD 3 - High-Pressure Decorative Laminates.

J. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII.

K. SEFA 2 - Installations.

L. SEFA 3 - Laboratory Work Surfaces.

1.04 SUBMITTALS

A. See Section 013000 - Administrative 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. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. 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.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. 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. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Quality Standard: SEFA 3 for laboratory worksurfaces.

C. 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.

1. Manufacturers:
   a. Durcon, Inc: www.durcon.com/#sle.
2. Flat Surface Thickness: 1 inch, nominal.
3. Chemical-Resistance: Provide products that resist the following chemicals with not more than Moderate Effect when tested in accordance with NEMA LD 3:
4. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
5. Surface Finish: Smooth, non-glare.
6. Color: Gray.
7. Exposed Edge Shape: 3/16 inch radius corner.
8. Back and End Splashes: Same material, same thickness; separate for field attachment.
9. Sinks: Same material, same color; integrally molded with counter; bottom sloped to outlet; molded outlets; drain outlet located in back corner.
   a. Sides and Ends: 1/2 inch minimum thickness.
   b. Bottoms: 5/8 inch minimum thickness.
   c. Interior Corners: 1 inch minimum radius.
   d. Clamping collars for 1-1/2 or 2 inch diameter waste pipe, for sealed but not permanent connection.
   e. Steel channel supports front to back on each side, fastened to underside of top to support twice full sink weight.
10. Associated Reagent Shelves and Ledges: Same material.
    a. Thickness: 3/4 inch.
11. Associated Window Sills: Same material.
    a. Thickness: 3/4 inch.
12. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

D. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, 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. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.
7. Fabricate in accordance with manufacturer's standard requirements.

E. Stainless Steel Countertops: Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.

1. Finish: 4B satin brushed finish.
2. Edge and Backsplash Sink Details: As indicated on drawings.
3. Associated Reagent Shelves: Same material, with formed raised edges.

2.02 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

B. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:

1. Material: Steel.
2. Finish: Manufacturer's standard, factory-applied, textured powder coat.

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 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, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.

1. Weld joints; grind smooth and polish to match.
2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
3. Provide wall clips for support of back/end splash turndowns.
4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.
5. Integral sinks: Fabricate with corners rounded and coved, double-walls for sink compartment partitions. Factory-punch holes for fittings, and weld sinks to countertops.

E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

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. Install laboratory worksurface countertops in compliance with requirements of SEFA 2.

B. Install vanities in accordance with manufacturer’s instructions and approved shop drawings

C. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

D. Attach stainless steel countertops using stainless steel fasteners and clips.

E. Attach epoxy resin countertops using compatible adhesive.

F. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

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 123600

SECTION 132100 – CONTROLLED ENVIRONMENTAL ROOMS

PART 1 - GENERAL

1.1 SYSTEM AND PERFORMANCE DESCRIPTION

A. Section includes: Provide all labor, materials, equipment and services necessary to complete the Controlled Environment Rooms work in accordance with the Contract Documents including, but not limited to, the following:

1. Prefabricated all metal clad construction, furnished and installed as a complete self-contained unit and system, with all essential plenums, controls, balanced air circulation and all other equipment necessary to reach the environmental conditions specified herein.
2. Factory assembled and tested major components, including air handler, condensing unit and control panels prior to delivery.
3. Delivery of the room components to their final location and complete assembly of the rooms in place.
4. Condensing units are water cooled. Units are located as identified in Article 2.11.
5. Refrigeration piping, condensate drains to floor drain.
6. Electrical power wiring, control wiring and connections which are an integral part of the rooms and between the remote condensing units.
7. Maintain noise levels in special purpose room enclosures during steady state control conditions below NC-65 curve over audible frequency range as measured by standard ASA methods when external ambient is 85 decibels or less.
8. Temperature Range: Coordinate final Control and Performance with Owner and Architect.
9. Start-up and field-testing of the rooms as described in Field Quality Control Testing.
10. Shelving by Owner. Coordinate with Owner for required backing if wall shelving will be provided.
11. All penetrations through the environmental structure required by this Section will be provided for by this Section, including vapor seals.
12. Provide closure angles or plates to adjacent wall, ceiling and floor surfaces.

B. Related Sections:

1. Division 21 – Fire Protection: Sprinkler lines and heads.
2. Division 22 - Plumbing: Floor drain for condensate drains. Coordinate with Environmental room manufacturer.
3. Division 23 - Mechanical: Final connection locations to be coordinated with Mechanical Contractor and Environmental Room Contractor. Chilled water lines, isolation and balancing valves for condensing unit.
4. Division 26 - Electrical: Provide power to the environmental room control console and the refrigeration condensing units as required – Final connection locations to be coordinated with Electrical Contractor and Environmental Room Contractor.

1.2 WARRANTY

A. All equipment shall be guaranteed for a period of one year from the date of acceptance thereof, against defective materials, design and workmanship. In addition to overall warranty individual component manufacturer warranty shall include:

1. One (1) year parts warranty.
2. One (1) year labor warranty.
3. Five (5) years mechanical refrigeration compressors.
4. Ten (10) year insulated panel warranty.

1.3 QUALITY ASSURANCE

A. Bidder's Qualification: Work under this Section shall be performed in accordance with the requirements of the contract document.

B. Standard of Quality

1. The environmental room covered by this specification shall be the product of a manufacturer of this specific type of equipment with similar satisfactory installations in the field for 10 years or longer. The bidder must supply a list of similar installations.
2. Bidders shall have an established organization and production facilities specializing in the type of equipment bid with an experienced engineering department. Each shall have the demonstrated ability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.
3. Any deviations from the Specifications, including type of finishes as set forth herein, must be approved prior to bid and listed in detail, separate from the literature furnished with the bid, such that the owner does not have to expend excessive time in evaluating competitive bids. List of deviations shall be submitted along with the Contractor's proposal. Any bid will rightfully be construed as being based on supplying the design, construction and materials called for in this specification.
4. The bidder of rooms under this section is responsible for any alterations to the mechanical or electrical services as scheduled herein or as shown on plans which are necessary to accommodate the manufacturer's product requirement. The bidder shall include in his bid sufficient monies to cover such alterations. No extra charge will be allowed for service alterations after receipt of bid.
5. The environmental room design and installation shall conform to applicable codes, ordinances and regulations governing the use and safety of refrigerants including, but not be limited to, ASHRAE/ANSI standard 15-2001, ARI 420-77, ARI 520-78, NEMA-94.
6. The bidder shall be a manufacturer of environmental rooms which maintains factory parts and service. An extended warranty service contract shall be tendered at least one month prior to the end of the warranty period for consideration and acceptance by the owner.
7. The owner, or his designated representative, reserves, the right to reject any equipment which in his opinion does not meet the standard of quality established by these specifications. Any such decision will be considered final and not subject to further recourse.

1.4 PROJECT CONDITIONS

A. Scheduling and Coordination: the installer of the rooms shall examine project conditions at the site with regard to access and dimensions as they exist and the general areas of work, and shall perform work in such a manner as required to deliver, install and connect the rooms in close coordination with work of other trades.

1.5 SUBMITTALS

A. Shop Drawings, Product Data and Samples:

1. Shop Drawings: Include rough in, clearances, show layout, room dimensions, materials, wall backing locations, components, fasteners, doors, hardware, equipment, finishes, method of installation and assembly, supplementary support of bracing, controls and services roughing-in locations and maintenance requirements.
2. Product Data: Describe equipment, hardware and fixtures.
3. Access Points: Show on the shop drawing required access points for access to room and equipment housed above the unit. Include clearances required from other above ceiling services such as sprinkler piping and lighting fixtures. Label these as “no fly zones”.

B. Operation and Maintenance Data: Include instructions for sequential operation, start-up and shut down, with pertinent control data and schematics, and recommended maintenance of equipment.

C. At completion of work: Submit one copy of 3-ring binder containing: “as-built” drawings, product data, operation, and maintenance information listed above.

1.6 JOB CONDITIONS

A. Scheduling and Coordination: The room installer shall examine project conditions at the site with regard to access, dimensions, conditions as they exist and the general areas of work, and shall perform work in such a manner as required to deliver, install and connect the rooms in close coordination with work of other trades.

1.7 GUARANTEE/WARRANTY

A. Mechanical refrigeration equipment, parts and labor, shall be guaranteed for a period of five years from the date of room start-up and continuous operation.

B. Prominently place the name of installer/service agency to be contacted during warranty period.

1.8 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer’s unopened packaging until ready for installation.

B. Store in a weather tight location and protect from corrosive environments, distortion and other damage during delivery storage and handling.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN MANUFACTURER

A. Norlake Scientific is the basis of design (BOD) manufacturer.

2.2 OTHER ACCEPTABLE MANUFACTURERS

A. Provided the manufacture meets the standard of quality and design required, equipment from the following manufacturers is also acceptable.

1. Harris Environmental Systems, Inc. Andover, MA
2. Environmental Specialties, Raleigh, NC

B. Other products of similar types and configurations may be considered acceptable, subject to review prior to bid and approval by the architect and owner's representative.

2.3 CONSTRUCTION

A. The rooms shall be double wall, modular panel construction. No structural metal, wood or fiberglass material shall be used between interior and exterior skins. Interior walls, exterior walls and interior ceiling shall be 22 gauge smooth white steel, prepainted with two coats of polyester or modified epoxy enamel. Ceiling topside and floor bottomside to be 26 gauge smooth galvanized. Interior floor to be .100 smooth aluminum. Panel insulation shall be self-extinguishing, foamed-in-place polyurethane insulation providing a "K" factor of 0.139 BTU/ft^2/°F/inch of thickness or foamed-in-place isocyanurate insulation providing a "K" factor of 0.118 Btu/hour/square foot/degree Fahrenheit/inch of thickness. The overall coefficient of heat transfer ("U" Factor) shall not exceed .033 (R-30) for 4" thick walls. Insulation shall bond the panel and shall have a minimum compressive strength of 28 lbs/square inch. Panels shall meet UL 723 (ASTM E-84) fire test rating of 25 or less flame spread and display label accordingly.

B. Walls shall be a nominal 4" thick. Sections shall match without distortion and shall be aligned by tongue and groove joint, with flexible vinyl gasket to assure tight fitting joints Sections shall be fastened from the inside by cam lock devices, maximum 48" apart. Provide wall backing as required for casework and possible wall shelving. Finished walls shall factory painted white.

C. Roof panels shall be a minimum of 4" thick. Roof shall be properly reinforced to support equipment loads. Reinforcement shall not violate the insulation value of the panels. Roof panels shall be capable of withstanding a minimum 40 lbs/sq.ft live load, in addition to concentrated equipment loads. Rooms with equipment located on-top to have insulated service access panels inside the room.

D. The floor shall be 4" thick panels, unless noted otherwise, with aluminum top skin and ¾" CDX plywood subfloor. Floor panels shall be capable of withstanding uniformly distributed loads of 500 lbs./sq. ft. For rooms operating at 2°C and above 2" thick floor panels are acceptable. Provide resilient sheet flooring with integral cove base and shall be covered with a crevice-free, non-absorbent, slip-resistant, abrasive vinyl (90% virgin vinyl matrix), inlaid type having temperature stability, dimensional stability and flexibility from +60°C. to -20°C. Flooring shall be smooth, free of ribs or patterns. Flooring shall require no maintenance except cleaning with detergent and water. Depending upon room size, floors shall be seamless or seams shall be

welded. Floor covering shall be coved up the walls 4" high, capped with a vinyl trim piece and continuously silicone sealed between vinyl cap and walls. Floor covering color shall be selected by Architect. Refer to Finish Legend for sheet vinyl selection.

E. Ramps (slopes) to meet ADA (1/12 max slope) with contrasting flooring.

F. Furnish and install the necessary vertical and horizontal closure panels, strips and shrouds to enclose opening between environmental rooms and adjacent building partitions and ceiling. Finish to match adjoining units.

G. Doors shall be in fitting and semi-flush and provide a minimum clear opening of 36" x 78". Doors shall be provided with a minimum 14" x 14" insulated and sealed, three pane observation window with a ¼" air space between panes. Doors shall have thermal resistance within 10% of that of wall panels.

1. Door gaskets shall be extruded vinyl, resistant to oil, fats and sunlight and shall be easily replaceable. Gaskets shall be fitted with a magnetic steel core at sides and top of door. Provide an adjustable rubber wiper gasket at door bottom. Door pull strength to meet ADA.
2. Anti-sweat heaters to control condensation shall be provided as a standard item on all door jambs and view windows at rooms designed for operation below 5°C.
3. Door hardware shall meet ADA requirements complete with keyed cylinder lock. Lock mechanism shall meet ADA and be capable of release from the room's interior whether or not the door is locked. Hinges shall be polished aluminum, cam action type, self-closing, self-lubricating and edge or strap mounted. Pins shall be stainless steel and cam shall be Zytel. A minimum of two hinges shall be furnished per door. Hinges shall be adjustable for proper gasket seal.

H. The air system shall consist of ceiling mounted conditioning modules and a drop ceiling to form a positive pressure plenum across the environmental room ceiling for even distribution.

1. Ceiling panels shall be acrylic, egg crate, transparent type, or acoustic fiberglass may be used. Polystyrene-type material ceilings will not be acceptable.
2. No commercial fan-coil units shall be used. Conditioning modules shall be custom designed, sized, and manufactured to meet the temperature ranges and uniformity requirements of each chamber. The coil shall be copper tube, aluminum fin design with aluminum housing. The expansion valve, with strainer, heat exchanger, and inlet/outlet connections shall also be contained within this housing. Air circulation motors shall be permanently sealed. An aluminum drain pan with drain line shall be provided. Condensate lines of Type L copper tubing shall be routed out of each chamber and terminated at condensate drains located adjacent to each chamber.
3. The conditioned air shall pass into a positive pressure plenum extending across the room's ceiling. Plenum shall show the correct percentage of total opening to ensure uniform air distribution throughout the rooms to achieve and maintain performance specified.
4. Where required, environmental rooms shall have low level return air ducts to insure uniformity.

I. Service line penetration into rooms shall be properly sealed with silicone caulking.

J. Defrost system in rooms operating below 5°C (except freezers) shall be hot gas with automatic control of blowers during the defrost cycle. Timing and duration of the defrost system shall be programmed and controlled through the microprocessor temperature controller. Room

temperature rise shall not exceed 5°C during defrost. Freezers shall include electric defrost, drain pan heat and drain line heat trace.

K. Ventilation make-up air system to be coordinated with the HVAC drawings. If no ventilation make-up air shown on HVAC drawings, a system shall be installed on all chambers and shall include a filtered air intake. A manually operated slide damper shall be set during installation to provide the specified minimum quantity of make-up air. If no ventilation make-up air shown on HVAC drawings, make-up air will be drawn from ambient and require no connection to the building HVAC system.

Air inlet shall be positioned so that air passes through the air conditioning plenum prior to entering the work area. Exhaust shall be located as far as practical from inlet.

2.4 CONDENSING UNIT AND REFRIGERATION SYSTEM

A. Refrigeration System shall be an integrated systems consisting of an evaporator and condensing unit designed to operate continuously System capacity shall be sufficient to meet simultaneously and continuously:

1. Performance test requirements included in the Execution Section of this Specification.
2. Additional internal heat gain generated by user of equipment to be as shown on room schedule.

B. Condensing Unit shall be water-cooled, scroll, heavy-duty, industrial type with pressure, current, and temperature safety devices, integral suction and discharge valves. Provide unit with water regulating valves to control head pressure. Unit is to be located as shown on the approved shop drawings and provided with isolation mountings where required.

C. The condensing unit shall be specifically designed and manufactured with adequate capacity to fulfill the individual room's operating temperature requirements and performance and shall be balanced with the air handling system in operation. The condensing units shall be complete in all respects and shall include compressor, condenser, high/low pressure control, receiver, sight glass, expansion valve, interconnecting piping, piping insulation, fused disconnect switch, motor starter and all necessary equipment to achieve the performance of each room as shown on the enclosed schedule.

D. The condensing unit system shall be of the two-phase direct expansion type designed to operate continuously using a refrigeration bypass system control. The system shall provide temperature control through the continuous mixing of the liquid and hot-gas phase of refrigerant entering the evaporator. Cycling compressor systems will not be acceptable.

E. Equipment Room Contractor shall install refrigeration lines between compressor and room evaporator. The refrigeration system shall be evacuated by vacuum pump for initial leak testing and evacuation of all moisture and air within the systems. Lines shall be charged with refrigerant and rechecked with an electronic leak detector for presence of any refrigeration leaks. Provide all necessary line sizes, traps, etc., for proper operation of this equipment. The suction line shall be insulated with approved insulation. No CFC refrigerants will be accepted, refrigerants shall be “LEED” friendly. Room operating above 0°C shall use 404A.

F. Components:

1. Cold Room Evaporator Coil: copper tube, aluminum fin design with aluminum housing; minimum 8 fins per inch, minimum 4 rows deep. Air velocity shall be less than 500 fpm.
2. Tubing: Stainless Steel, Type 316 tubing for piping in contact with RO water, all other piping ACR type, hard drawn, cleaned and capped Type L copper tubing soldered with silver solder, except hot gas lines which shall be silver brazed. All lines shall be installed to allow for linear expansion of copper after start-up.

    a. Suction Lines: size for velocity of 500-700 fpm on horizontal runs and show a slight pitch toward condensing unit. When condensing unit is located below evaporator and there is no possibility of trapping oil, size vertical runs same as horizontal runs. When condensing unit is located above evaporator, size vertical runs for velocity of 1,000 - 1,500 fpm and install proper (shallow) "P" traps spaced not over 10' apart on all tubing risers.
    b. Hot Gas Lines: when hot gas lines are field installed remote from compressor, size tubing at same "P" trap requirements as specified above for suction lines.
    c. Liquid Lines: size all liquid lines for maximum 2 psig pressure drop.
    d. Hangers: F&M ring type or Unistrut assemblies with appropriate tubing clamps to support liquid, suction and discharge lines individually. Space hangers or clamps 8' o.c. maximum.
    e. Condensate Drain Piping: 7/8" o.d. or greater, type L copper tubing piped from evaporators to open floor drain or nearest sink, rigidly supported at walls 3' o.c. maximum, installed in such a manner that leaves 1" clearance space between wall and drain and equipped with clean out tee near evaporator. Adequately pitch piping toward floor drain, or sink, carry through wall of refrigerated areas properly trapped and discharged within 2' of floor drain. Provide chrome plated escutcheons on both sides of wall penetrations.
    f. Refrigerant Testing: pressurize and leak test entire system at not less than 100 psig, clean and dehydrate by maintaining a vacuum of 500 microns, or lower, for a five hour period. Add required charge of refrigerant, and oil if necessary, and test entire system for performance. Mark each system clearly as to refrigerant type used.
    g. Insulation: fire retardant Armstrong "Armaflex Insulation" or equal for insulating refrigeration suction lines. Use minimum 1/2" thick wall; apply during tubing, assemble wherever possible.

2.5 INSTRUMENT AND CONTROL SYSTEMS

A. Main Temperature Control: Microprocessor based Proportional Integral and Derivative (PID) controller designed for environmental room applications with the following features:

1. Resistance Temperature Detector (RTD) 1000 ohm platinum sensor for rapid response to temperature fluctuation, open tip for environmental rooms. Sensitivity shall be greater than or equal to ± 0.1° C.
2. The microprocessor PID controller shall continuously monitor room condition versus setpoint, providing an output which will modify the conditioning system capacity in response to any deviation.
3. Controller range shall be established to cover the required range of the room as scheduled.
4. Accuracy ± 0.5% of span typical, ± 1 digit for display at 25° C.
5. Ambient Temperature Error - 0.01% of span per degree C deviation from 25°C.

6. Resolution - 1 degree/unit.
7. Calibration Drift - Self-compensating for ambient temperature. All calibration values shall be stored in memory. No field calibration shall be required.
8. Noise Rejection - Normal mode, 60 dB minimum at 60 Hz.
9. Common mode, 90 dB minimum.

B. Controller shall be A-B 850 PLC with 7" HMI, or Carel PCO 5+, or equal.

C. Dehumidification:

1. Main Dehumidification Control: Microprocessor based Proportional Integral and Derivative (PID) controller designed for environmental room applications with the following features:

   a. Thin Film or Bulk Capacitance Sensor: Sensitivity shall be greater than or equal to ± 2%.
   b. The microprocessor PID controller shall continuously monitor room condition versus setpoint, providing an output which will modify the conditioning system capacity in response to any deviation.
   c. Controller range shall be established to cover the required range of the room as scheduled.
   d. Accuracy - ± 0.5% span or ± 1 digit for display.
   e. Ambient Temperature Error - 0.01% of span per % R.H. deviation from 25° C.
   f. Resolution - 1% R.H./unit.
   g. Calibration Drift - Self-compensating for ambient temperature. All calibration values shall be stored in memory. No field calibration shall be required.
   h. Noise rejection - Normal mode, 60 dB minimum at 60 Hz.
      1) Common mode, 90 dB minimum.
   i. Controller shall be Allen Bradley 850 PLC with 7" HMI.

D. Alarm and Safety Control System: Equip room with electronic high/low alarm and safety control.

1. Alarm system components:

   a. RTD sensor electronic temperature control with dual setpoints. Device shall have exposed setpoints in the control panel and shall provide independent high and low alarm outputs.
   b. An alarm circuit board including control relays, solid state circuiting, an alarm buzzer, input/output termination and a "remote alarm" dry contact relay.
   c. Control panel mounted components including the high/low setpoints specified above, high-alarm lights, a "silence" switch which silences the alarm, and a control alarm override switch used to restart the system.
   d. Alarm setpoints shall be visible through an LED readout. No dials, set screws or switches shall be required.

2. Alarm System Functioning:

   a. Alarm circuitry is an "always alive" circuit. Upon deviation in room temperature or power failure to room, the remote alarm relay will close giving a remote signal.
   b. Alarm circuit cannot be shut off. It can be made inoperative by establishing the setpoints too wide and the control portion can be bypassed but it cannot be electrically shut off when room main power switch is on.

c. When room rises above high temperature setpoint, "high" pilot lights, buzzer sounds, and all heat-producing devices shut down including light, fans, and door heat. Remote alarm relay shifts giving a normal open or closed signal. System remains in this state until temperature drops, at which time system automatically resets.
d. The Alarm Buzzer can be silenced for a minimum of 15 minutes and a maximum of 60 by pushing the "silence" switch. When the alarm condition clears, this portion automatically resets ready for next alarm. Silencing alarm does not shut off remote alarm. At the conclusion of the timed sequence the buzzer will sound again unless the room is again within design parameters.
e. When room drops below setpoint, "low" pilot lights, buzzer sounds, and power to all cold-producing components including refrigeration solenoids is removed. Remote alarm relay shifts giving a normal open or closed signal. System operates as specified herein for override, silencing, etc.
f. The "override" switch on the alarm control is designed to temporarily bypass the alarm system in an effort to regain room control. In the event that an alarm condition is caused by a prolonged door opening or power failure, this function will allow power to all drives in an attempt to regain performance. If the room has not reached setpoint within (15) minutes, the alarm will sound and the system shall operate as described above under high/low alarm. During the 15 minute override, the audio/ visual alarm indicators will be off.

E. Control Panel:

1. Install all instruments, controls, and major electrical components in a surface mounted painted steel combination control enclosure adjacent to room door. Enclosure shall be of welded construction. Exposed screws or rivets will not be allowed. Control Panel must be tested, accepted and labeled per UL 508A standard.
2. Provide control panel with easy access service door for front servicing of major electrical and instrument components.
3. Provide recessed control center at panel front protected with a hinged acrylic cover with lock to prevent unauthorized adjustments.
4. In addition to control instruments, panel shall contain all circuit fusing, timers, switches, pilot lights, main and safety controls, alarms, and all other devices required for system operation.
5. Label all control functions with descriptive nameplates or lenses on control panel face.
6. Mount a complete schematic of entire control system on inside face of control panel.
7. Provide dry contacts for connection to building direct digital control system and security system.

F. Temperature Recorder: paperless data recording shall be done by PLC.

2.6 LIGHTING

A. Lighting shall be LED enclosed in vapor proof fixture for 120V/60Hz operation. The light fixtures for the rooms shall be Underwriter's Laboratories approved and shall be rated to operate at the room's design temperatures. Light fixtures shall be mounted at ceiling. Light fixtures to be of sufficient quantity and intensity to provide a minimum of 70 foot-candles at 40" A.F.F. and to be so installed as to provide uniform distribution of light. Light switch shall be located outside of rooms on or near the control panel, convenient to door entrance and properly identified.

2.7 PERSONNEL EMERGENCY ALARM

A. The rooms shall be provided with reset type, electrically powered personnel emergency alarm system; power shall be provided by the room's electrical input. The system shall consist of an actuator within the rooms and audible and visual alarms affixed to the front exterior of the rooms and an extra control for the central security control console by providing two dry contacts.

B. The alarm actuator shall be a heavy duty, oil-tight switch equipped with a red button marked "EMERGENCY ALARM - PULL TO RESET". The actuator shall be mounted on the interior wall of the room's adjacent to the door jamb and 12" above the finish floor.

C. The audible alarm shall be of a type that provides a high decibel level of sound output at a frequency distinct from the room's parameter alarms. The visual alarm shall be mounted in an area providing no vision interference and shall be prominently labeled "PERSONNEL EMERGENCY".

2.8 ELECTRICAL OUTLETS

A. Vapor proof duplex, GFI receptacles foamed into place. Provide outlets as shown on electrical drawings or a minimum of 10 outlets per room at 42” A.F.F. Coordinate final locations with Architectural and Electrical Drawings.

2.9 DATA OUTLETS

A. Vapor proof duplex, foamed into place. Provide two outlets per room at 42” A.F.F. Coordinate final locations with Data/Communications Drawings.

2.10 SERVICE REQUIREMENTS

A. Electrical – This Sub-contractor shall provide coordination information for the Electrical Sub-contractor.

B. Mechanical – This Sub-contractor shall provide coordination information for the Mechanical Sub-contractor.

2.11 CONTROL AND PERFORMANCE PARAMETER

A. The conditions in the attached schedule shall be maintained in an ambient environment of: Summer Temp DB/WB is 75°F/63°F and Winter DB is 70°F. No humidity control in winter.

B. Schedule:

	Room Numbers	Temp. Range	Relative Humidity	Range	Fresh Air	Air
1	C1001L	2°C to 40°C Variable	40% RH (+/-5%)@ all temperatures	+5%.	40 CFM	@60° Saturated

C. Control of temperature: +0.2 C at the temperature measurement sensor.

D. Temperature Uniformity: +0.5 degree C is the variation in temperature between any points in the working area of the room as measured by a multi-point strip chart recorder using a minimum of twelve thermocouples located throughout the working chamber. Measurements shall be made 12" away from the interior room walls, a minimum of 6 feet from the ventilation supply air diffuser.

2.12 MECHANICAL/ELECTRICAL EQUIPMENT REQUIREMENTS

A. Condensing Unit.

	Room Numbers	Condenser	Evaporator	Condensing Unit Location	Running Load Amps	Voltage
1	C1001L	By Mfr – Water cooled	By Mfr	On top of Room	By Mfr	208V 40A/3, 3phase, 3wire service plus ground

B. Coordinate location of condensing units and length of refrigerant piping. Provide appropriate type and size of piping and adjust equipment sizing as needed.

C. Control Panel: 208V 40A/3, 3phase, 4wire service plus ground.

D. Desiccant Dehumidifier

Room Numbers	Type	Size	HP FLA	Voltage
C1001L	By Mfr	By Mfr	By Mfr	By Mfr

E. Humidifier

Room Numbers	Type	Water Quality	Water
C1001L	By Mfr	Softened Water	+/- 1 GPM

F. Electric Heaters

Room Numbers	Type	HP FLA	Voltage
C1001L	By Mfr	By Mfr	208

PART 3 - EXECUTION

3.1 COORDINATION

A. Equipment Vendor shall review clearances required for room equipment servicing that occur outside and above the footprint of the assembled room with the contractor or contractors involves to insure that access is not obstructed by other permanent installations.

3.2 DELIVERY AND INSTALLATION

B. The intent of these specifications is to require delivery and installation of all work at such times as construction and mechanical and electrical work have advanced to the point where the building is ready to receive equipment and permit installation.

C. The Architect reserves the right to inspect any pieces of fabricated equipment at the manufacturers or supplier's plant, provided, however, that he has notified the supplier, in writing, of his intention to do so, and no piece of fabricated equipment shall be delivered before said inspection has been made by the Architect.

D. All material required by these specifications shall be delivered to the building, uncrated, set and secured in designated locations, level and true.

E. Clear away and remove from the premises, as directed, all excess material, crates, boxes, paper and rubbish resulting from these operations.

F. Final connections shall be made as outlined in Paragraph 1.1B.

3.3 TESTING & TRAINING

A. This contractor to verify control accuracy with a separate strip chart multi-point recorder and provide results to the Owner for final acceptance. This contractor to perform a training session at the Owner's convenience for purposes of familiarizing Owner's staff with the complete operation of the control panels relative to each room.

3.4 MAINTENANCE MANUALS

A. When equipment is delivered and installed, three complete manuals shall be provided to the Owner to include technician's service manual, wiring schematics, parts list and warranty information. Coordinate with paragraph 1.7.

END OF SECTION 132100

SECTION 200000 - GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

A. Products for Temporary Facilities and Controls

1. Materials
2. Temporary Facilities

1.02 SCOPE OF WORK

A. This specification section is intended to act as a supplement to Division 01 of the project manual. In the instance that this project includes a Division 01, the requirements therein supersede the requirements of this section, except the requirements for coordination amongst the divisions as stated below. If the project manual does not address requirements included below, this section prevails.

B. It is intended for the Division 20, 21, 22, 23 scope of work to include complete and functional systems - including all required materials, labor, equipment, and services necessary to achieve the desired final product. It is further intended for the Division 20 scope of work to include coordination with Divisions 21 and 22 and Division 23 for complete Fire Protection, Plumbing and HVAC systems.

C. These specifications and accompanying drawings are intended to communicate the design concept for this project and outline the scope of work. They should not be viewed as a comprehensive document that details every specific task, item, or piece of equipment required to complete the project.

D. It is understood that industry knowledge and experience is required to establish an accurate and complete scope of work from these documents, and it is assumed that the Division 20, 21, 22, 23 Contractors possess that knowledge and experience.

E. Work not specifically noted in these specifications or the accompanying drawings, but which is required to complete the project, shall be included by the Division 20, 21, 22, 23 Contractors as part of their scope of work.

F. These specifications and the accompanying drawings are the “contract documents”, intended to supplement each other. Information included in either one shall be incorporated into the project as if included in both. In the event of any conflicts, the most stringent requirements shall be considered the governing scope of work until and unless clarification can be obtained by the Contractor.

G. In the event of dimensional discrepancies between Division 20, 21, 22, 23 documents and other disciplines, Architectural and Structural documents take precedence over Division 20, 21, 22, 23. Refer to this information for sufficient understanding to the extent that it impacts the Division 23 scope of work.

H. Drawings are intended to indicate the general arrangement of piping, ductwork, equipment and other components of Division 20, 21, 22, 23 systems. They shall be followed as closely as possible, but shall be considered diagrammatic in nature. They are not intended to show every component, fitting, offset, etc. Components, fittings, offsets, etc. as required to meet the intent of the documents and to achieve coordination with other trades shall be included in the Division 20, 21, 22, 23 scope of work. Note that more detailed information about routing may be provided for certain areas of the project where special constraints exist. It is the intent of this detailed information to better communicate the constraints, but these drawings and details shall still be considered diagrammatic in nature as outlined above.

I. Routing and Locations

1. It is the Contractor's responsibility to coordinate equipment locations and system routing with available space and with all other trades.
2. It is the Contractor's responsibility to coordinate and verify the exact locations and routing of equipment and systems prior to fabrication and installation. If discrepancies become apparent as part of the verification process, the Contractor shall ask for written clarification/direction. Alteration, removal and/or replacement of work already installed as a result of failure to verify and/or coordinate locations and routing prior to fabrication and/or installation shall be at the Contractor's expense.
3. Locations of equipment shown on the drawings are approximate unless specifically dimensioned.
4. All ductwork, piping, tubing, conduit, etc. shall be concealed within building construction unless noted otherwise. Mechanical rooms are considered to be within building construction for the purposes of this requirement.
5. Existing utilities, piping, and ductwork have been indicated as closely as possible. The Contractor can assume that points of connection to existing utilities have been shown within 10 feet of the actual location. When actual points of connection are more than 10 feet 10 feet (3 meters) from the location shown on the drawings, the Contractor shall notify the Owner's Representative prior to commencing this portion of the work.
6. The Contractor is responsible for any remedial work required from failure to locate and preserve underground utilities. This shall include all work necessary to repair any damaged utilities to their original condition.

J. Scheduling

1. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner's Representative. The Contractor shall familiarize himself with his scope of work as well as the required coordination with other trades and the scheduling of other trades sufficiently to address coordination issues in a timely manner such that they do not result in remedial work for other trades.
2. Should conditions arise where certain changes would be advisable, secure approval from Owner's Representative for those changes before proceeding with work. Proceeding without written approval is at the Contractor's risk and at the Contractor's expense.
3. The Contractor shall coordinate with the work of various trades when installing interrelated work. Before installation of mechanical items, proper provisions shall be made to avoid interferences. Changes required in work specified in Division 20, 21, 22, 23 caused by neglect to do so shall be made at no cost to Owner.

4. Inserts and supports required by Division 20, 21, 22, 23 shall be furnished and installed unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 20, 21, 22, 23.

K. Cutting and Patching

1. The Division 20, 21, 22, 23 Contractor shall be responsible for all cutting and patching required to complete the Division 20, 21, 22, 23 scope of work.
2. All patching shall be performed such that it matches existing finishes.
3. The Contractor shall not cut any structural members without first getting approval from the Owner's Representative to do so.
4. All cutting and patching required to correct defective or otherwise unacceptable work shall be the responsibility of the Division 20, 21, 22, 23 Contractor.

L. Guarantee

1. All Division 20, 21, 22, 23 systems]and equipment shall be guaranteed for a minimum period of one year.
2. Specific equipment and/or systems requiring warranties beyond one year are indicated in the table at the end of this section and/or within individual Division 21, 22 and 23 specification sections.
3. The guarantee shall begin at the Date of Acceptance, unless written documentation is provided noting otherwise. When more than one Date of Acceptance is indicated for various portions or specific equipment, the guarantee shall begin at the Date of Acceptance independently for each portion of the system or piece of equipment.
4. Permission to use Division 20, 21, 22, 23 systems or equipment for temporary heating or other contractor use prior to the Date of Acceptance, as outlined elsewhere in these specifications, shall not constitute the beginning of the guarantee period. The contractor shall make any necessary arrangements to extend equipment and/or system warranties sufficient to maintain the designated guarantee period from the Date of Acceptance.
5. Exception: When temporary heating and or other system use is requested by the Owner for the Owner's benefit prior to the Date of Acceptance, the guarantee period for the portions of the system or specific equipment requested for use may begin at the time it is put into service. This can only be assumed to have occurred if written documentation is provided indicating such.

1.03 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.

1.04 RELATED REQUIREMENTS

A. Division 01 "Payment Procedures" for submitting Applications for Payment and the schedule of values.

B. Division 01 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.

C. Division 01 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.

D. Division 01 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.

1.05 APPLICABLE CODES AND STANDARDS

A. Division 20, 21, 23, 23 work shall be performed in accordance with applicable codes and standards as adopted by the Authorities Having Jurisdiction including amendments.

1.06 ABBREVIATIONS AND ACRONYMS

1.07 SUBMITTALS

A. General

1. The Contractor is responsible for identifying all required submittals throughout these specifications and following the required procedures for each type of submittal.

B. Action Submittals

1. Action Submittals: Written and graphic information and physical samples that require Engineer’s and Construction Manager 's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
2. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
3. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number
4. Submittal Procedures:
    a. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
        1) Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
        2) Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
    b. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1) Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   (a) Identification of products.
   (b) Schedules.
   (c) Compliance with specified standards.
   (d) Notation of coordination requirements.
   (e) Notation of dimensions established by field measurement.
   (f) Relationship and attachment to adjoining construction clearly indicated.
   (g) Seal and signature of professional engineer if specified.

c. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1) Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2) Manufacturer and product name, and model number if applicable.
   3) Number and name of room or space.
   4) Location within room or space.

d. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

e. Certificates:
   1) Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
   2) Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
   3) Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
   4) Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
   5) Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
   6) Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

f. Test and Research Reports:

1) Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2) Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3) Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4) Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

g. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
h. The product is a ‘Major’ piece of equipment
i. The product contains refrigerant
j. The cost of a group of products serving a given function constitutes 5% or greater of the sub-contractor’s budget, excluding labor.

C. Delegated Design Services

1. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   a. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Engineer.
2. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   a. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services

D. Contractor's Review

1. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer and Construction Manager.

2. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
    a. Engineer and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

E. Engineer's Review

1. Action Submittals: EngineerEngineer and Construction Manager will review each submittal, indicate corrections or revisions required and return it
    a. PDF Submittals: Engineer and Construction Manager will indicate, via markup on each submittal, the appropriate action.
2. Submittals by Web-Based Project Software: Engineer and Construction Manager will indicate, on Project software website, the appropriate action.
3. Informational Submittals: Engineer and Construction Manager will review each submittal and will not return it or will return it if it does not comply with requirements. Engineer and Construction Manager will forward each submittal to appropriate party.
4. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer and Construction Manager.
5. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
6. Engineer and Construction Manager will discard submittals received from sources other than Contractor.
7. Submittals not required by the Contract Documents will be returned by Engineer without action.
8. Except for demonstrating compliance with Sustainable Design and Construction requirements, MSDS are not required and will not be reviewed. Submittals received that contain MSDS will be returned by Engineereer without action.
9. A maximum of two re-submittals shall be reviewed by the Engineer. The Client shall be entitled to deduct from the Contractors Contract Sum, amounts paid to Engineer to review more than the noted quantity of resubmittals.
10. Materials or equipment that are procured, and work that is executed, without completing Action Submittal review shall be at the Contractor's risk.
11. Review will be for general conformance only and shall not relieve the Contractor for any deviations from the requirements of the documents.

F. Substitution Procedures

1. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.

b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Client and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may 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 Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

   a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.

   b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

4. 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.

5. Procedures

   a. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

6. Substit

   a. Contractor's Responsibilities: By making requests for substitution, the Contractor:

      1) Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.

      2) Certifies that the cost data submitted is complete and includes all related costs under this Contract except the Engineer's evaluation and redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent.

      3) Will submit for Engineer's evaluation all product data and samples deemed necessary by the Engineer. Such submission does not relieve Contractor for submission of specified product submittals and shop drawings.

      4) Contractor initiated proposals: The Owner shall be entitled to a deduct from the Contract Sum amounts paid to the Engineer to evaluate Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of such substitutions.

b. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than [15] days prior to time required for preparation and review of related submittals.
    1) Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
        (a) Requested substitution is for a specified product that is no longer available, and offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner may have to assume. Owner’s additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction, and similar considerations.
        (b) Requested substitution does not require extensive revisions to the Contract Documents.
        (c) Requested substitution is consistent with the Contract Documents and will produce indicated results.
        (d) Substitution request is fully documented and properly submitted.
        (e) Requested substitution will not adversely affect Contractor's construction schedule.
        (f) Requested substitution has received necessary approvals of authorities having jurisdiction.
        (g) Requested substitution is compatible with other portions of the Work.
        (h) Requested substitution has been coordinated with other portions of the Work.
        (i) Requested substitution provides specified warranty.
        (j) 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.

c. Substitutions for Convenience: Engineer will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.
    1) Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
        (a) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
        (b) Requested substitution does not require extensive revisions to the Contract Documents.
        (c) Requested substitution is consistent with the Contract Documents and will produce indicated results.

(d) Substitution request is fully documented and properly submitted.

(e) Requested substitution will not adversely affect Contractor's construction schedule.

(f) Requested substitution has received necessary approvals of authorities having jurisdiction.

(g) Requested substitution is compatible with other portions of the Work.

(h) Requested substitution has been coordinated with other portions of the Work.

(i) Requested substitution provides specified warranty.

(j) 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.

G. Alternates

1. Procedures
   a. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
      1) Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
2. Execute accepted alternates under the same conditions as other work of the Contract.
3. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

1.08 WARRANTIES

A. General Warranty Requirements

1. The warranty period shall begin at the date of Substantial Completion.
2. If temporary use of equipment and/or systems is allowed prior to substantial completion, that shall not initiate the warranty period unless specifically noted otherwise. The warranty period shall be extended for equipment and systems as required to comply with the project warranty requirements.
3. Provide software and firmware updates for all equipment and systems that become available during the warranty period.
4. Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

B. Special Warranty Requirements

1. Warranty requirements included in individual specification sections are supplemental to the general warranty requirements for the project. All requirements are intended to be additive, and in no way to lessen general project warranty requirements. If general project warranty requirements are more stringent than requirements listed in an individual section, the more stringent requirement shall take precedence.

2. Documentation shall be provided for required additional warranties, and included in Operation and Maintenance Materials.

1.09 QUALITY ASSURANCE

A. Delegated Design Services

B. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

C. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

D. Conflicting Requirements

1. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.
2. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 DELIVERY, STORAGE AND HANDLING

A. Follow individual product specifications if directions supersede this section.

B. Follow manufacturer’s directions in delivery, storage, protection, and installation of equipment and materials.

C. Promptly notify Owner’s Representative in writing of conflicts between requirements of Contract Documents and Manufacturer’s directions and obtain written instructions from Owner’s Representative before proceeding with work. The Contractor shall bear expenses arising from correcting deficiencies of work that do not comply with manufacturer’s directions or such written instructions from Owner’s Representative.

D. Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

E. Store ductwork in a clean, dry location. If the location of storage cannot be protected from moisture, keep ductwork above grade level to protect from standing water.

1.11 PERMITS AND FEES

A. All permits and inspections required to complete the Division 20, 21, 22 23 scope of work shall be included in the prices of the respective divisions' bid prices. All certifications provided as part of the permit and inspection process shall be provided to the Owner as part of the Mechanical scope of work as specified in these documents.

B. All fees required by utility providers shall be included in the 20, 21, 22, 23 bid price, including water, gas, sanitary sewer, and storm sewer connections. This shall include all charges to the project by these agencies, including but not limited to general fees, equipment charges (meters, vaults, etc.), tap fees, and utility main installation charges.

1.12 VISITING THE PROJECT SITE

A. The premises shall be examined and conditions shall be understood which may affect performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine existing site conditions.

PART 3 EXECUTION

2.01 MECHANICAL DEMOLITION

A. Refer to Division 01 and Division 02 for general demolition requirements and procedures.

B. Disconnect, demolish, and remove Fire Protection systems, HVAC systems, Plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

2.02 WORK IN EXISTING BUILDINGS

A. Access to the existing building will be provided by the owner as required and a project schedule will identify access requirements to occupied buildings. Work shall be completed by the Contractor without interruption once Work has begun to facilitate returning the areas of work back to the Owner as soon as possible.

B. Provide adequate protection of all existing and newly installed Work. Contractor shall promptly repair any damage to new or existing Work at Contractor's expense.

C. Contractor shall consult with the Owner on methods of performing Work so the Owner's operation is not disrupted more than absolutely necessary. The Owner shall designate when interruption of existing services may occur. Contractor shall leave all services in operation until such time.

D. All items and equipment removed as part of the demolition process shall remain property of the owner unless possession rights are waived. Contractor shall meet with Owner prior to start of demolition to determine which items are to be salvaged. Contractor shall remove remaining items from the site

END OF SECTION 200000

SECTION 200500 - COMMON MECHANICAL WORK RESULTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion Fittings and Loops for Piping

1. Performance Requirements
2. Grooved-Joint Expansion Joints, Lead Free – Plumbing Piping Only
3. Grooved-Joint Expansion Joints – HVAC Piping Only
4. Alignment Guides and Anchors - HVAC and Plumbing Piping

B. Sleeves and Sleeve Seals for HVAC and Plumbing Piping

1. Sleeves without Waterstop
2. Firestop Systems
3. Grout
4. Silicone Sealants

C. Escutcheons and Floor Plates for HVAC and Plumbing Piping

1. Escutcheons
2. Floor Plates

1.02 GENERAL REFERENCES

A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Division 22 Section "Domestic Water Piping Specialties" for water meters.

B. Division 22 Section "General-Service Compressed-Air Piping" for compressed air gauges.

C. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.04 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled

1.05 **PERFORMANCE REQUIREMENTS**

A. Domestic water expansion fittings and loops for plumbing piping intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.

C. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

D. Capability: HVAC Products

1. Refrigerant piping: Comply with ASME B31.5.

E. Capability: Products to absorb 200 percent of maximum axial movement between anchors

1.06 SUBMITTALS

A. Action Submittals

1. For each type of product
   a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
   b. Include operating characteristics and furnished accessories
2. Delegated Design Submittals: For each anchor and alignment guide, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.
   a. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
   b. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
   c. Alignment Guide Details: Detail field assembly and attachment to building structure.
   d. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
3. Sustainable Design Submittals:
   a. Product Data: For sealants, indicating VOC content.

b. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

c. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

B. Informational Submittals

1. Welding certificates.
2. Submittal:
   a. Product Schedule: For each penetration firestopping system, include location and design designation of qualified testing and inspection agency.

1.07 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Qualifications:

1. Contractor: Contractor is responsible for quality of the Work.
2. Manufacturer: A firm experienced in successfully producing work similar to that indicated for this Project with sufficient production capacity to produce required units without causing delay in the Work.
3. An installer trained by the manufacturer in the use of the materials and equipment to be employed in the Work.

1.08 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

D. Under provisions of commissioning documentation; testing of mechanical equipment, as well as training of owner’s operation and maintenance personnel, shall be required in cooperation with the commissioning agent.

E. Refer to the Owner/Utility tie-in schedule.

F. Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work.

G. Each contractor shall coordinate its operations with operations, included in different sections, which depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

H. Contractor shall participate in whole building information modeling coordination process utilizing a three-dimensional software platform compatible with Autodesk® Navisworks®. Contractor shall include all time associated with detailing, coordination meetings, and model generation for the BIM coordination process.

1.09 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials in manufacturer’s original packaging with label indicating pertinent information identifying the item.

1. Pertinent Information: Manufacturer’s labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency’s classification marking applicable to Project; curing time, and mixing instructions for multicomponent materials.

B. Storage and Handling Requirements: Store materials in accordance with manufacturer’s instructions in a protected dry location off ground. Do not open packaging nor remove labels until time of installation.

C. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes

D. Deliver ductwork, pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent ductwork and pipe end damage and to prevent entrance of dirt, debris, and moisture.

E. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

F. During installation, provide temporary caps of sufficient material to prevent entrance of dirt, debris, and moisture.

PART 2 PRODUCTS

2.01 EXPANSION FITTINGS AND LOOPS FOR PIPING

A. Performance Requirements:

1. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Products to absorb 200 percent of maximum calculated axial movement between anchors.

B. Packless Expansion Joints:

1. Flexible-Hose Packless Expansion Joints, Lead Free – Plumbing Piping Only:
   a. Manufacturers:
      1) Flex-Hose Co., Inc.
      2) Flex-Pression.
      3) Flexicraft Industries.
      4) Mason Industries, Inc.
      5) Metraflex Company (The).
   b. Source Limitations: Obtain flexible-hose packless expansion joints from single manufacturer.
   c. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
   d. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
   e. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
      1) Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
   f. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
      1) Stainless steel hoses and double-braid, stainless steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

C. Alignment Guides and Anchors - HVAC and Plumbing Piping:

1. Alignment Guides:
   a. Manufacturers:
      1) Advanced Thermal Systems, Inc.
      2) Flex-Hose Co., Inc.
      3) Flexicraft Industries.
      4) Metraflex Company (The).
   b. Source Limitations: Obtain alignment guides from single manufacturer.
   c. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe. Provide dielectric spacer for use with copper tubing/piping.
2. Anchor Materials – HVAC and Plumbing Piping:
   a. Steel Shapes and Plates: ASTM A36/A36M.
   b. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
   c. Washers: ASTM F844, steel, plain, flat washers.

d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
    1) Stud: Threaded, stainless steel.
    2) Expansion Plug: Stainless steel.
    3) Washer and Nut: Stainless steel.
e. Chemical Fasteners: Insert-type stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
    1) Bonding Material: ASTM C881/C881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    2) Stud: ASTM A307, stainless steel with continuous thread on stud unless otherwise indicated.
    3) Washer and Nut: Stainless steel

2.02 SLEEVES AND SLEEVE SEALS FOR HVAC AND PLUMBING PIPING

A. Sleeves without Waterstop:

1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: {RS#477}, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653/A653M, 24 gauge minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint

B. Firestop Systems

1. Manufacturers:
    a. HoldRite HydroFlame, a Brand of Reliance Worldwide Corporation
    b. 3M
    c. Specified Technologies Inc. (STI)
2. Design Criteria:
    a. For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance of assembly penetrated.
        1) Fire-resistance-rated walls, including partitions, with fire-protection-rated openings.
        2) Fire-resistance-rated floor and roof assemblies.
    b. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined by ASTM E814, but not less than that equaling, or exceeding fire-resistance rating of constructions penetrated.
    c. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings, as determined by ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent combustible materials in occupied floor areas:

1) Penetrations located outside wall cavities.
2) Penetrations located outside fire-resistive shaft enclosures.

d. L-Rating: Per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
e. W-Rating: Penetrations in horizontal assemblies, provide penetration firestopping showing no evidence of water leakage when tested to UL 1479.

3. Penetration Firestopping:
   a. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
4. Fill Material:
   a. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors.
   b. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
   c. Firestop Devices: Factory-assembled collars formed from galvanized and lined with intumescent material sized to fit specific diameter of penetrant.
   d. Intumescent Wrap Strips: Single-component intumescent strips.
   e. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants; pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag (caulk-grade) for openings in vertical and sloped surfaces

C. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

D. Silicone Sealants

1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.
   a. Manufacturers
      1) GE Construction Sealants; Momentive Performance Materials Inc.
      2) ITW Polymers Sealants North America.
      3) Polymeric Systems, Inc.
      4) Sherwin-Williams Company (The).
      5) Sika Corporation.
      6) The Dow Chemical Company.
      7) Tremco Incorporated.
2. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

3. Silicone Sealant, S, P, T, NT: Single-component, 25, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
    a. Manufacturers:
        1) Pecora Corporation.
        2) Sika Corporation.
        3) The Dow Chemical Company.
        4) Tremco Incorporated.
4. Standard: ASTM C920, Type S, Grade P, Class 25], Uses T and NT.
5. Silicone Foam Sealant: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
    a. Manufacturers:
        1) Smooth-On

2.03 ESCUTCHEONS AND FLOOR PLATES FOR HVAC AND PLUMBING PIPING

A. Escutcheons:

1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

B. Floor Plates

1. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
2. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 EXECUTION

3.01 APPLICATION

A. Sleeves Application

1. Use sleeves and sleeve seals for the following piping-penetration applications:
    a. Interior Wall and Partitions:
        1) Sleeves without waterstops.

B. Escutcheons Application

1. Escutcheons for New Piping and Relocated Existing Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
b. Chrome-Plated Piping: One piece, steel with polished, chrome-plated finish.
c. Insulated Piping:
1) One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
a. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces:
a. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
4. Escutcheons for Existing Piping to Remain:
a. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish
b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
5. Install floor plates for piping penetrations of equipment-room floors.
6. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
a. New Piping and Relocated Existing Piping: One piece, floor plate.
b. Existing Piping: Split floor plate.

3.02 **INSTALLATION**

A. Installation of Expansion Joints, General

1. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Installation of Packless Expansion Joints

1. Install metal-bellows expansion joints in accordance with EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

C. Installation of Alignment Guides and Anchors

1. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
2. Install two guides on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
3. Attach guides to pipe, and secure guides to building structure.
4. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
5. Anchor Attachments:
a. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9.

b. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-58, Type 24; U bolts bolted to anchor.

6. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
   a. Anchor Attachment to Steel Structural Members: Attach by welding.
   b. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
   c. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

D. Installation of Pipe Loop and Swing Connections

1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
2. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
3. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

E. Installation of Sleeves - General

1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
2. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   a. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   b. Cut sleeves to length for mounting flush with both surfaces.
      1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   c. Using silicone sealant, seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.
3. Install sleeves for pipes passing through interior partitions.
   a. Cut sleeves to length for mounting flush with both surfaces.
   b. Install sleeves that are large enough to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation.
   c. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.
   d. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Division 07 Section "Penetration Firestopping."

F. Installation of Fire Stop Systems

1. Examination

a. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping.

2. Preparation
   a. Surface Preparation: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer.
3. Installation
   a. Install systems in accordance with manufacturer's printed installation instructions, submittals, applicable industry standards, applicable UL Systems, and governing regulatory requirements for the Work.

G. Installation of Escutcheons

1. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
2. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening

H. Equipment Installation - Common Requirements

1. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated or coordination with other services dictates different mounting heights.Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.Install HVAC, Plumbing, and Fire Protection equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.Install equipment to allow right of way for piping installed at required slope.

3.03 **FIELD QUALITY CONTROL**

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:
   a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
   b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates

3.04 ERECTION OF SUPPORTS AND ANCHORAGES

A. Metal

1. Refer to Division 05 Section 05 00 00 "Metal Fabrications" for structural steel.

2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
   a. Provide all supplementary steel to provide proper drainage for gravity flow systems.
3. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 200500

SECTION 210500 - COMMON WORK RESULTS FOR FIRE-PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hangers and supports.

B. General Duty Valves for Water-Based Fire-Protection Systems.

C. Identification for fire-protection piping and equipment.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.

1.04 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene propylene diene monomer.

B. FM: Factory Mutual Global.

C. GPM: Gallons (U.S.) per minute.

D. NFPA: National Fire Protection Association.

E. NPS: Nominal pipe size.

F. NRS: Non-rising stem.

G. OS&Y: Outside screw and yoke.

H. PSIG: Pounds per square inch gauge.

I. SBR: Styrene-butadiene rubber.

J. UL: Underwriter’s Laboratories.

1.05 DEFINITIONS

A. Standard-Pressure Valves: Valves designed and listed to operate at a working pressure of 175 psi maximum.

1.06 PERFORMANCE REQUIREMENTS

A. Hangers and Supports:

1. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
2. NFPA Compliance: Comply with NFPA 13.
3. UL Compliance: Comply with UL 203.

B. General Duty Valves for Water-Based Fire Protection Systems:

1. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
   a. Automated Sprinkler Systems:
      1) Valves.
         (a) Gate valves.
         (b) Check valves.
         (c) Miscellaneous valves.
2. ASME Compliance:
   a. ASME B16.1 for flanges on iron valves.
   b. ASME B1.20.1 for threads for threaded-end valves.
   c. ASME B31.9 for building services piping valves.
3. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
4. NFPA Compliance for valves:
   a. Comply with NFPA 13, NFPA 14, NFPA 20 and NFPA 24.
5. Valve Pressure Ratings: Not less than the minimum pressure rating as required by the maximum system pressure at location of valve.
6. Valve Sizes: Same as upstream piping unless otherwise indicated.
7. Valve Actuator Types:
   a. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
   b. Handwheel: For other than quarter-turn trim and drain valves.
   c. Hand lever: For quarter-turn trim and drain valves NPS 2 and smaller.

1.07 SUBMITTALS

A. Action Submittals

1. Product Data:
    a. For each type of product, excluding motors which are included in Part 1 of the fire-protection equipment Sections.
        1) Include construction details, material descriptions, and dimensions of components.
        2) Include operating characteristics and furnished accessories.
2. Valve numbering scheme.
3. Valve Schedules: Provide for fire-suppression piping systems. Include in operation and maintenance manuals.

B. Informational Submittals

1. Field quality-control reports.
2. Welding certificates.

C. Closeout Submittals

1. Furnish copy of latest edition of NFPA 25 “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.”
2. After completing a fire-protection system installation, the Contractor shall submit to the authority having jurisdiction a written certification that the system has been installed in accordance with the approved plans and tested in accordance with NFPA 13 and manufacturer’s recommendations.

D. Operation and Maintenance Materials

1. Include manufacturer’s descriptive literature, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data.

E. Record Documents

1. Record As-built drawings.
2. Record digital files.
    a. Digital layout models.
    b. Product data.
    c. Final submittals with responses.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity and possessing documentation proving successful completion of fire protection systems training.

B. Codes and NFPA Standards: Materials, equipment and installation of hangers and supports for fire protection piping shall comply with NFPA 13, local building codes and the requirements of all Authorities Having Jurisdiction.

C. Hangers and supports for fire protection piping shall be listed and labeled by Underwriters Laboratories and approved by FM Global.

D. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped in the part itself for identification.

E. Hangers and supports shall be designed and manufactured in conformance with MSS SP-58.

F. Certifications: Provide letters of certification as follows.

1. Installer will utilize skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed tradesperson.

G. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

H. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

1.09 MOCK-UPS AND SAMPLES

1.10 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 PRODUCTS

2.01 HANGERS AND SUPPORTS

A. Metal Pipe Hangers and Supports:

1. Carbon-Steel Pipe Hangers and Supports:

a. Description: Factory-fabricated components, NFPA approved, UL listed and FM approved for fire-suppression piping support.
b. Galvanized Metallic Coatings: Pre-galvanized or hot-dip galvanized.
c. Hanger Rods: Continuous-thread rod, nuts, and washer made of electro-galvanized carbon steel.

2. Stainless-Steel Pipe Hangers and Supports:
a. Description: Factory-fabricated components, NFPA approved, UL listed or FM approved for fire-suppression piping support.
b. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Trapeze Pipe Hangers:

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with NFPA approved, UL listed and FM approved electro-galvanized carbon-steel hanger rods, nuts, saddles, and U-bolts

C. Metal Framing Systems:

1. MFMA Manufacturer Metal Framing Systems:
a. Manufacturers:
1) B-line, an Eaton business.
2) Flex-Strut Inc.
3) Unistrut; Part of Atkore International.
b. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
c. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
d. Channels: Continuous slotted carbon-steel channel with in-turned lips.
e. Channel Width: Selected for applicable load criteria.
f. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
g. Hanger Rods: Continuous-thread rod, nuts, and washer made of electro-galvanized carbon steel.
h. Metallic Coating: Pre-galvanized G90.
i. Paint Coating: Green epoxy, acrylic, or urethane.
2. Non-MFMA Manufacturer Metal Framing Systems:
a. Manufacturers:
1) Anvil International.
2) ERICO International Corporation.
3) PHD Manufacturing, Inc.
b. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
c. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
d. Channels: Continuous slotted carbon-steel channel with in-turned lips.
e. Channel Width: Select for applicable load criteria.

f. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
g. Hanger Rods: Continuous-thread rod, nuts, and washer made of electro-galvanized carbon steel.
h. Metallic Coating: Pre-galvanized G90.
i. Paint Coating: Green epoxy, acrylic, or urethane.

D. Fastener Systems:

1. Powder-Actuated Fasteners: NFPA-approved, UL-listed, and FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   a. Manufacturers:
      1) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.
2. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, and FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   a. Manufacturers:
      1) B-line, an Eaton business.
      2) Hilti, Inc.
      3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      4) MKT Fastening, LLC.
   b. Indoor Applications: Zinc-coated or Stainless steel.
   c. Outdoor Applications: Stainless steel.

E. Pipe Stands:

1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured electro-galvanized carbon steel components to support piping

F. Equipment Supports:

1. Design Mix: 5000-psi, 28-day compressive strength

G. Materials:

1. Carbon Steel: ASTM A1011/A1011M.
2. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
3. Stainless Steel: ASTM A240/A240M.
4. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrinking and nonmetallic grout; suitable for interior and exterior applications.
   a. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrinking and nonmetallic grout; suitable for interior and exterior applications.

b. Design Mix: 5000-psi, 28-day compressive strength.

2.02 GENERAL DUTY VALVES FOR WATER-BASED FIRE-PROTECTION SYSTEMS

A. Two-Piece Ball Valves with Indicators:

1. Manufacturers:
   a. Ames Fire & Waterworks; A Watts Water Technologies Company.
   b. NIBCO INC.
   c. Victaulic Company.
2. Description:
   a. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port Size: Full or standard.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Worm gear or traveling nut.
   i. Supervisory Switch: Internal or external.
   j. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
   k. End Connections for Valves NPS 2-1/2: Grooved ends.

B. Bronze Butterfly Valves with Indicators:

1. Manufacturers:
   a. Milwaukee Valve Company.
2. Description:
   a. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
   b. Body Material: Bronze.
   c. Seat Material: EPDM.
   d. Stem Material: Bronze or stainless steel.
   e. Disc: Bronze with EPDM coating.
   f. Actuator: Worm gear or traveling nut.
   g. Supervisory Switch: Internal.
   h. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
   i. Ends Connections for Valves NPS 2-1/2: Grooved ends.

C. Iron Butterfly Valves with Indicators:

1. Manufacturers:
   a. Kennedy Valve Company; a division of McWane, Inc.

b. NIBCO INC.
c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
d. Victaulic Company.
e. Zurn Industries, LLC.

2. Description:
a. Standard: UL 1091 UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
b. Body Material: Cast or ductile iron [with nylon, EPDM, epoxy, or polyamide coating].
c. Seat Material: EPDM.
d. Stem: Stainless steel.
e. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
f. Actuator: Worm gear or traveling nut.
g. Supervisory Switch: Internal.
h. Body Design: Grooved-end connections.

D. Iron OS&Y Gate Valves:

1. Manufacturers:
a. American Cast Iron Pipe Company.
b. Clow Valve Company; a subsidiary of McWane, Inc.
c. Hammond Valve.
d. Mueller Co. LLC; Mueller Water Products, Inc.
e. NIBCO INC.
f. Victaulic Company.
g. WATTS; A Watts Water Technologies Company.
h. Zurn Industries, LLC.

2. Description:
a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves)
b. Body and Bonnet Material: Cast or ductile iron.
c. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
d. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
e. Stem: Brass or bronze.
f. Packing: Non-asbestos PTFE.
g. Supervisory Switch: External.
h. End Connections: Flanged.

E. NRS Gate Valves:

1. Manufacturers:
a. American Cast Iron Pipe Company.
b. Clow Valve Company; a subsidiary of McWane, Inc.
c. Mueller Co. LLC; Mueller Water Products, Inc.

d. NIBCO INC.
e. Victaulic Company.
f. Zurn Industries, LLC.

2. Description:
a. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
b. Body and Bonnet Material: Cast or ductile iron.
c. Wedge: Cast or ductile iron with elastomeric coating.
d. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
e. Stem: Brass or bronze.
f. Packing: Non-asbestos PTFE.
g. Supervisory Switch: External.
h. End Connections: Flanged.

F. Trim and Drain Valves:

1. Ball Valves:
a. Manufacturers:
1) Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International.
2) Fire-End & Croker Corporation.
3) Milwaukee Valve Company.
4) NIBCO INC.
5) Potter Roemer LLC; a Division of Morris Group International.
6) Red-White Valve Corp.
7) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
8) Victaulic Company.
9) WATTS; A Watts Water Technologies Company.
10) Zurn Industries, LLC.
b. Description:
1) Body Design: Two-piece.
2) Body Material: Forged brass or bronze.
3) Port size: Full or standard.
4) Seats: PTFE.
5) Stem: Bronze or stainless steel.
6) Ball: Chrome-plated brass.
7) Actuator: Hand lever.
8) End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
9) End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

2. Angle Valves:
a. Manufacturers:

1) Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International.
2) NIBCO INC.
3) United Brass Works, Inc.

b. Description:
1) Body Material: Brass or bronze.
2) Ends: Threaded.
3) Stem: Bronze.
4) Disc: Bronze.
5) Packing: Asbestos free.
6) Handwheel: Malleable iron, bronze, or aluminum.

3. Globe Valves:
a. Manufacturers:
1) NIBCO INC.
2) United Brass Works, Inc.

b. Description:
1) Body Material: Bronze with integral seat and screw-in bonnet.
2) Ends: Threaded.
3) Stem: Bronze.
4) Disc Holder and Nut: Bronze.
5) Disc Seat: Nitrile.
6) Packing: Asbestos free.
7) Handwheel: Malleable iron, bronze, or aluminum.

2.03 IDENTIFICATION FOR FIRE-PROTECTION PIPING AND EQUIPMENT

A. Warning Signs and Labels:

1. Manufacturers:
a. Brady Corporation.
b. Carlton Industries, LP.
c. Champion America.
d. Craftmark Pipe Markers.
e. Emedco.
f. LEM Products Inc.
g. Marking Services Inc.
h. National Marker Company.
i. Pipemarker.com; Brimar Industries, Inc.
j. Seton Identification Products; a Brady Corporation company.
k. Stranco, Inc.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, 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.
9. Label Content: Include caution and warning information, plus emergency notification instructions.

B. Warning Tape:

1. Manufacturers:
   a. Brady Corporation.
   b. Craftmark Pipe Markers.
   c. National Marker Company.
   d. Pipemarker.com; Brimar Industries, Inc.
   e. Seton Identification Products; a Brady Corporation company.
2. Material: Vinyl.
3. Minimum Thickness: 0.005 inch.
4. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.
5. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.
6. Maximum Temperature: 160 deg F.
7. Minimum Width: 4 inches.

C. Pipe Labels:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
   b. Brady Corporation.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. Emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services Inc.
   j. Pipemarker.com; Brimar Industries, Inc.
   k. Seton Identification Products; a Brady Corporation company.
2. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
3. Letter and Background Color: As indicated for specific application under Part 3.

4. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
5. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
6. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
    a. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
    b. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

D. Stencils:

1. Manufacturers: Provide products by one of the following manufacturers:
    a. Craftmark Pipe Markers.
    b. Kolbi Pipe Marker Co.
    c. Marking Services Inc.
    d. Pipemarker.com; Brimar Industries, Inc.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

E. Valve Tags:

1. Manufacturers: Provide products by one of the following manufacturers:
    a. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
    b. Brady Corporation.
    c. Carlton Industries, LP.
    d. Champion America.
    e. Craftmark Pipe Markers.
    f. Emedco.
    g. Kolbi Pipe Marker Co.
    h. LEM Products Inc.
    i. Marking Services Inc.
    j. Pipemarker.com; Brimar Industries, Inc.
    k. Seton Identification Products; a Brady Corporation company.
2. Description: Stamped or engraved with 1/4 inch letters for piping-system abbreviation and 1/2 inch numbers.
    a. Tag Material: Brass, 0.032 inch, stainless steel, 0.025 inch, aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
    b. Fasteners: Brass wire-link chain or beaded chain.

3. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
    a. Include valve-tag schedule in operation and maintenance data.

F. Warning Tags:

1. Manufacturers:
    a. Brady Corporation.
    b. Champion America.
    c. Craftmark Pipe Markers.
    d. Emedco.
    e. Kolbi Pipe Marker Co.
    f. LEM Products Inc.
    g. Marking Services Inc.
    h. Pipemarker.com; Brimar Industries, Inc.
    i. Seton Identification Products; a Brady Corporation company.
2. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
    a. Size: 3 by 5-1/4 inches minimum.
    b. Fasteners: Reinforced grommet and wire.
    c. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

G. Identification Signs:

1. Hydraulic Design Information Sign:
    a. Identify all hydraulically designed sprinkler systems, in accordance with NFPA system requirements with a permanently marked (by engraving) weatherproof metal or rigid plastic sign. The signs shall be secured with corrosion resistant wire or chain. Such signs shall be located at the sprinkler system control valve supplying the corresponding hydraulically designed area.
    b. The sign shall include the location of the design area, discharge densities over the design area, flow and residual pressure demand at the base of the riser, occupancy classification or commodity classification and maximum permitted storage height and configuration, hose stream allowance included in addition to the sprinkler demand, and the name of the installing contractor.
2. Identification of Valves:
    a. All control, drain, and test connection valves shall be provided with a permanently marked (by engraving) weatherproof metal or rigid plastic identification signs. The identification signs shall be secured with corrosion resistant wire or chain.
    b. The sign shall identify purpose of valve and the portion of the building served.
3. General Information Sign:

a. Provide a general information sign, conforming to NFPA 13, used to determine system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25, “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.”

H. Fire Protection System Diagrams:

1. Provide fire protection system diagrams, drawn to scale, framed and under glass to be permanently posted in a conspicuous location in the fire pump room. Diagrams shall show the water supply, fire pumps, fire department connections, sprinkler and standpipe mains, risers and all valves.

PART 3 EXECUTION

3.01 APPLICATION

A. Hangers and Supports:

1. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 250 lb.
2. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
5. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
6. Use galvanized or stainless-steel pipe hangers and attachments for hostile environment applications, including but not limited to outdoor areas, corrosive areas, high moisture areas, and over pools and in pool equipment rooms.
7. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   a. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   b. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
   c. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes NPS 1/2 to NPS 8.
   d. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated stationary pipes NPS 3/8 to NPS 8.
   e. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes NPS 3/8 to NPS 3.
   f. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

g. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

h. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

i. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

8. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
9. Hanger-Rod Attachments: Comply with NFPA requirements.
10. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    a. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
    b. C-Clamps (MSS Type 23): For structural shapes.
    c. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
11. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    a. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
    b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
    c. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
12. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
13. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
14. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

B. General Duty Valves:

1. Source limitations: Obtain each type of valve from single manufacturer.
2. Control valves on the suction side of fire pumps shall be OS&Y type.
3. Fire pump discharge check valve shall be Factory Mutual approved as an anti-water hammer check valve.

3.02 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.03 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.04 INSTALLATION

A. Hangers and Supports:

1. General:
    a. Sprinkler piping shall be supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lb. applied at the point of hanging.
    b. Do not support piping from other pipes, ductwork, other equipment, or anything else that is not part of the building structure.
    c. Hanger rod sizes shall be in conformance with the requirements of NFPA 13.
    d. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
    e. Riser Installation:
        1) Risers shall be supported by riser clamps or by hangers located on the horizontal piping connections within 24 inches of the centerline of the riser.
        2) Riser clamps supporting risers by means of set screws shall not be used.
        3) Riser clamps anchored to walls using hanger rods in the horizontal position shall not be permitted to vertically support risers.
        4) In multistory buildings, riser supports shall be provided at the lowest level, at every level above, above and below offsets, and at the top of the riser.
        5) Supports above the lowest level shall also restrain the pipe to prevent movement by an upward thrust where flexible fittings are used.
        6) Where risers offset, the first ceiling level above the offset shall constitute the first level of riser support.
        7) Distance between supports for risers shall not exceed 15 feet.

f. Metal Trapeze Pipe-Hanger Installation: Trapeze hangers shall be used where necessary to transfer loads to appropriate structural members. Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1) Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2) Field fabricated from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
   3) The minimum size of steel angle or pipe span between purlins or joists shall be such that section modulus shall not exceed section modulus of trapeze member as shown in the NFPA 13.
   4) The trapeze member shall be secured to prevent slippage.
   5) All components of each hanger assembly that attaches to the trapeze member shall be sized to support the suspended sprinkler pipes in accordance with NFPA 13.
   6) Any other sizes or shapes giving greater section modulus than required by NFPA 13 shall be acceptable.
   7) Sprinkler piping may be supported from trapeze hangers supporting both sprinkler piping and ductwork or equipment provided such trapeze hangers comply with NFPA 13 requirements for the total supported load of all equipment plus a minimum of 250 lb. and provided such trapeze hangers are supported from the building structure.

g. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

h. Fastener System:
   1) Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
   2) Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
   3) Provide inserts for placement in formwork before concrete is poured.
   4) Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   5) Where concrete slabs form finished ceilings, provide inserts to be flush with slab surface.
   6) Powder-driven studs shall not be used in steel of less than 3/16 inch total thickness.
   7) Increaser couplings shall be attached directly to the powder-driven studs.
   8) Listed inserts in concrete and listed post-installed anchors to support hangers shall be used for mains and branch lines.

9) Post-installed anchors shall not be used in cinder concrete except for branch lines where the post-installed anchors are alternated with through-bolts or hangers attached to beams.
10) Post-installed anchors shall be installed in a horizontal position in the sides of concrete beams.
11) Holes for post-installed anchors in the side of beams shall be above the centerline of the beam or above the bottom reinforcement steel rods.
12) Holes for post-installed anchors used in the vertical position shall be drilled to provide uniform contact with the shield over its entire circumference.
13) The depth of the post-installed anchor hole shall not be less than specified for the type of shield used.
14) Welding studs or other hanger parts shall not be attached by welding to steel less than U.S. Standard, 12 gauge.

i. Pipe Stands:
1) Pipe stands shall be sized to support a minimum of 5 times the weight of the water-filled pipe, plus 250 lb.
2) Where pipe stands are utilized, they shall be approved.

j. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

k. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

l. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

m. Install lateral bracing with pipe hangers and supports to prevent swaying.

n. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

o. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

p. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

q. Fasteners used to support sprinkler system piping shall not be attached to a ceiling of gypsum board or other similar soft material.

r. Distance between a hanger and the centerline of an upright sprinkler shall not be less than 3 inches.

s. The cumulative horizontal length of an unsupported arm-over to a sprinkler, sprinkler drop, or sprig shall not exceed 24 inches for steel pipe or 12 inches for copper pipe.

t. The cumulative horizontal length of an unsupported arm-over to a pendent sprinkler below a ceiling supplied from a branch line above the ceiling shall not exceed 12 inches for steel pipe or 6 inches for copper tube where the maximum static or flowing pressure, whichever is greater at the sprinkler exceeds 100 psi.

u. Sprigs 4 feet or longer shall be restrained against lateral movement.

v. Eye rods shall be secured with lock washers to prevent lateral motion.

w. Eye rods shall be backed with a large flat washer bearing directly against the structural member in addition to lock washer where eye rods are fastened to the wood structural member.

x. Minimum Coach Screw Rod Size: The size of coach screw rods shall not be less than 3/8 inch for pipe sizes supported up to 4 inches. Coach screw rods are not permitted for support pipes larger than 4 inches.

y. The minimum plank thickness and the minimum width of the lower face of beams or joists in which coach screw rods are installed shall be in accordance with NFPA 13.

2. Metal Fabrications:

a. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

b. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

c. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2) Obtain fusion without undercut or overlap.

3) Remove welding flux immediately.

4) Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

B. General Duty Valves for Water-Based Fire-Protection Systems:

1. General:

a. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

b. Install valves in horizontal piping with stem at or above the pipe center.

c. Install valves in position to allow full stem movement.

d. Install listed fire-protection shutoff valves supervised-open (except pump test connection valve which shall be supervised-closed), located to control sources of water supply except from fire-department connections.

C. Pipe Loops and Swing Connections:

1. Install pipe loops and offsets in accordance with NFPA 13 requirements for expansion and contraction compensation.

3.05 PAINTING

A. Hangers and Supports:

1. Touchup:

a. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
    1) Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.06 IDENTIFICATION

A. General:

1. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
2. Coordinate installation of identifying devices with locations of access panels and doors.
3. Install identifying devices before installing acoustical ceilings and similar concealment.
4. Locate identifying devices so that they are readily visible from the point of normal approach.

B. Equipment Labels, Warning Signs, and Labels:

1. Permanently fasten labels on each item of fire-suppression equipment.
2. Sign and Label Colors: White letters on an ANSI Z535.1 safety-red background.
3. Locate equipment labels where accessible and visible.
4. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

C. Warning Tape:

1. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.
2. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.
3. Locate tape so as to be readily visible from the point of normal approach.

D. Pipe Labels:

1. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
2. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
    a. Identification Paint: Use for contrasting background.
    b. Stencil Paint: Use for pipe marking.
3. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

a. Within 3 ft. of each valve and control device.
b. At access doors, manholes, and similar access points that permit a view of concealed piping.
c. Within 3 ft. of equipment items and other points of origination and termination.
d. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.

4. Flow Direction Arrows: Provide arrows to indicate direction of flow in pipes including pipes where flow is allowed in both directions.
5. Fire Protection Pipe Label Color: White letters on an ANSI Z535.1 safety-red background.

E. Valve Tags:

1. Install tags on valves and control devices in fire protection piping systems. List tagged valves in a valve-tag schedule in the operating and maintenance manual. Include the identification “FPV” on all fire-protection system valve tags.
2. Valve tag size and shape: 2 inches, round.
3. Valve-Tag Color: White letters on an ANSI Z535.1 safety-red background.

F. Warning Tags:

1. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.
2. Attach warning tags, with proper message, to equipment and other items where required by NFPA standards, drawings and/or specifications.

3.07 ADJUSTING

A. Hangers:

1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
2. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

END OF SECTION 210500

SECTION 211000 - WATER-BASED FIRE-PROTECTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-protection piping, fittings, and appurtenances.

1. Steel fire-protection piping, fittings, and appurtenances.

B. Fire-protection piping specialties.

C. Sprinklers.

D. Pipe expansion loops and joints.

E. Alarm devices.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Contract Documents: Refer to complete set of Contract Documents for requirements that are related to or may affect the work described in this Section.

B. Section 200500 “Common Mechanical Work Results” for sleeves, stack-sleeve fittings, sleeve-seal systems, escutcheons, floor plates, grout, and silicone sealants.

C. Section 210500 “Common Work Results for Fire-Protection” for fire protection hangers and supports, general duty valves and identification for fire protection piping and equipment.

1.04 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority Having Jurisdiction.

B. FM: Factory Mutual Global.

C. GPM: Gallons (U.S.) per minute.

D. NFPA: National Fire Protection Association.

E. NPS: Nominal pipe size.

F. PSIG: Pounds per square inch gauge.

G. UL: Underwriters Laboratories.

1.05 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with local building codes and standards of all authorities having jurisdiction for design and installation of water-based fire protection systems.

B. NFPA Compliance: Comply with NFPA 13 "Standard for the Installation of Sprinkler Systems" for sprinkler system design, construction, and installation standards.

C. Fire-Protection System Components, Devices, and Accessories: Listed in UL's "Fire Protection Equipment Directory" and FM Globals' "Approval Guide."

D. 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.

E. Fire-Protection system equipment, specialties, accessories, installation, and testing to comply with NFPA 13 and NFPA 14.

F. Standard-Pressure Piping System Component: Listed for 175 psig minimum working pressure.

G. Piping, fittings, valves, and specialty valves shall be rated for the maximum system working pressure. Use of pressure regulating valves (except for individual pressure reducing/restricting fire hose valves) shall not be permissible, unless noted otherwise.

H. Delegated Design: Engage a qualified professional engineer or NICET certified technician, "Water-Based Systems Layout" with appropriate certified NICET level as required by the local jurisdiction to design fire-protection systems.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Maximum Protection Area per Sprinkler: As noted on drawings and shall not exceed NFPA 13 and FM Global requirements and limitation indicated on drawings.
3. Total Combined Hose-Stream Demand Requirement: As noted on drawings and shall not be less than that required by NFPA 13 and FM Global.

I. Obtain documented approval of Fire-Protection system design from AHJs.

J. Pipe, fittings, valves, specialty valves and sprinklers shall be rated and listed for the maximum system working pressure. The use of pressure reducing or regulating valves shall not be permissible unless noted otherwise.

1.06 SUBMITTALS

A. Action Submittals

1. Product Data:
    a. For each type of product.
        1) Include construction details, material descriptions, dimensions of individual components and profiles.
        2) Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings:
    a. Prepare in accordance with NFPA 13 section "Working Plans."
        1) Include plans, elevations, and sections of the system piping and details.
        2) Include detailed riser diagram and schematic diagram showing system supply, supply connection, devices, valves, pipe, and fittings, as well as the delineation of the standard-pressure and high-pressure portions of the fire protection system.
        3) Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    b. Prepare computer-generated hydraulic calculations in accordance with the following:
        1) NFPA 13 requirements for sprinkler systems.
        2) Factory Mutual requirements for sprinkler systems.
        3) NFPA 13 requirements for standpipe systems. Minimum operating pressure at hydraulically most remote fire hose valve is to be 100 psig.
        4) Name of hydraulic program used.
        5) Water supply information, including fire hydrant flow test data report.
    c. Include diagrams for power, signal, and control wiring.
    d. Contractor shall provide PE-stamped copies of Shop Drawings and Hydraulic Calculations to the following for approval:
        1) Ithaca Fire Department
        2) Cornell Environment, Health and Safety
        3) Cornell Fire Protection Engineer
        4) FM Global
3. Delegated Design Submittals: Submit documents and calculations for fire-protection systems indicated to comply with performance requirements and design criteria, including analysis data, signed, and sealed by the qualified professional engineer responsible for their preparation or prepared by NICET certified technician, "Water-Based Systems Layout" with appropriate certified NICET level as required by the local jurisdiction. NICET certified-technician submittals are to include the following information on each drawing title block: technician's name, NICET certification number, and NICET certification specialty area and level.

B. Informational Submittals

1. Coordination Drawings: Fire-protection system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.
2. Qualification Data: For qualified Installer, professional engineer, and NICET-certified technician.

3. Design Data: Approved fire protection working plans, prepared in accordance with NFPA 13, including documented approval by AHJs, and including hydraulic calculations.
4. Field Test Reports:
    a. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
    b. Fire-hydrant flow test report.
5. Field quality-control reports.

C. Closeout Submittals

1. Furnish copy of latest edition of NFPA 25 “Standard for the Inspection, Testing, and Maintenance of Water-Based Fire-Protection Systems.”
2. After completing a fire protection system installation, the Contractor shall submit to the authority having jurisdiction a written certification that the system has been installed in accordance with the approved plans and tested in accordance with NFPA 13 and manufacturer’s recommendations.

D. Operation and Maintenance Materials

1. Include manufacturer’s descriptive literature, operating instructions, cleaning procedures, replacement parts list, maintenance data, and repair data.
2. Include valve tag schedule.

E. Record Documents

1. Record As-built drawings.
2. Record hydraulic calculations.
3. Record digital files.
    a. Digital layout models.
    b. Product data.
    c. Final submittals with responses.

1.07 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-protection systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET certified technician, "Water-Based Systems Layout" with appropriate certified NICET level as required by the local jurisdiction.
    b. An experienced installer who has designed, installed, and obtained approvals for fire-Protection sprinkler systems like that indicated for this Project.

c. Prior to commencing work, submit data showing that the Contractor has successfully installed Fire Protection systems of the same type and design as specified herein, or that they have a firm contractual agreement with a subcontractor having the required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that the system has performed satisfactorily for a period of at least 18 months.

d. Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of, an individual who is experienced with the types of works specified herein. Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

B. Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code.

C. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

1.08 DELIVERY, STORAGE AND HANDLING

A. Store products in shipping containers until installation. Provide and maintain temporary inlet and outlet caps until installation.

B. Glass bulb sprinklers shall be shipped and stored with protective bulb shields. Bulb shields shall be removed after installation and before placing the system in service.

C. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

D. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

E. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

F. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

G. Protect stored materials from moisture and dirt. Do not store outside. Do not exceed structural capacity of floor when storing inside.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.10 FIELD CONDITIONS

A. Interruption of Existing Fire Protection System Service: Do not interrupt fire protection service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire protection service according to requirements indicated:

B. Notify Bid Opening Time no fewer than two days in advance of proposed interruption of fire protection service.

C. Do not proceed with interruption of fire protection service without Bid Opening Time 's written permission.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Automatic wet-pipe sprinkler system.

2.02 FIRE-PROTECTION PIPING, FITTINGS, AND APPURTENANCES

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials and for joining methods for specific services, service locations, and pipe sizes.

B. Steel Pipe, Fittings, and Appurtenances:

1. Schedule 40 Steel Pipe: Galvanized- and black-steel pipe, {RS#477}, ASTM A135/A135M, or ASTM A795/A795M, with flanged, threaded, roll grooved, or cut grooved joints. Welded joints are also acceptable for black steel pipe only.
   a. Factory-applied exterior coating.
   b. Pipe ends may be factory or field formed to match joining method.
2. Steel Pipe Nipples: Galvanized and black steel, ASTM A733, made of {RS#477} , standard-weight, seamless steel pipe with threaded ends.
3. Steel Couplings: Galvanized and uncoated steel, ASTM A865/A865M, threaded.

4. Cast-Iron, Malleable-Iron and Ductile-Iron Threaded Fittings: Galvanized and uncoated threaded fittings, ASME B16.4, Class 125 and Class 150, standard pattern.
5. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
    a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
    c. Metal, Pipe-Flange Bolts and Nuts: ASME B18.21.1 carbon steel unless otherwise indicated.
6. Grooved-Joint, Steel-Pipe Appurtenances:
    a. Manufacturers: Provide products by one of the following manufacturers:
        1) Gruvlok; an ASC Engineered Solution.
        2) Shurjoint; a part of Aalberts Integrated piping Systems.
        3) Smith-Cooper International.
        4) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
    b. Victaulic Company.
    c. Pressure Rating: 300 psig minimum.
    d. Grooved-End Fittings for Steel Piping: Painted grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
    e. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 FIRE-PROTECTION PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers:
    a. ASC Engineered Solutions, Gruvlok Figure 7046.
    b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America, Grinnell Figure 730.
    c. Victaulic Company, Figure 920 and 920N.
2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Galvanized and painted, two-piece flanged ductile-iron housing with bolted connections. U-bolt and snap on type outlets are not acceptable.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved or threaded.

B. Branch Line Testers:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. AGF Manufacturing, Inc.
   b. Croker; a Division of Morris Group International.
   c. Potter Roemer LLC; a Division of Morris Group International.
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

C. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Viking Group Inc.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Adjustable Drop Nipples:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. Aegis Technologies, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

E. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. Flexhead; an ASC Engineered Solution – Model Superflex for maximum system pressures of 175 psi.
   b. Victaulic Company – Model AH2 for maximum system pressures of 175 psi and AH2-300 for maximum system pressures of 300 psi.
   c. Victaulic Company – VicFlex model VS-1 dry pendent flexible sprinkler for maximum system pressures of 175 psi.

d. Victaulic Company – AB6 Hanger Bracket Assembly with Victaulic Model AH2 or AH2-CC in lieu of rigid pipe offsets or return bends for sprinkler drops in wet, dry, and preaction systems in cold storage applications, the Victaulic VicFlex™ V33, V36, or V40 Dry Sprinkler with Integral AB6 Assembly may be used for maximum system pressures of 175 psi.

2. Standards:
   a. UL 2443.
   b. FM 1637.
3. Description: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

F. Automatic (Ball-Drip) Drain Valves:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Viking Group Inc.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

G. Manual Air Vent/Valve:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. AGF Manufacturing, Inc.
2. Description: Ball valve that requires human intervention to vent air.
3. Body: Forged brass.
4. Ends: Threaded.
5. Minimize Size: 1/2 inch.
6. Minimum Water Working Pressure Rating: 300 psig.

H. Automatic Air Vent:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. AGF Manufacturing, Inc.
   b. CLA-VAL.
   c. Engineered Corrosion Solutions.
   d. Metraflex Company (The).
   e. Reliable Automatic Sprinkler Co., Inc. (The).
2. Description: Automatic air vent that automatically vents trapped air without human intervention. Approved for use in wet-pipe fire-Protection system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.

5. Minimum Water Working Pressure Rating: 175 psig minimum.

I. Automatic Air Vent Assembly:

1. Manufacturers: Provide products by one of the following manufacturers:
   a. AGF Manufacturing, Inc.
   b. Engineered Corrosion Solutions.
   c. South-Tek Systems, LLC.
2. Description: Automatic dual air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly. Approved for use in wet-pipe Fire-Protection system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig minimum.

2.04 SPRINKLERS

A. Manufacturers:

1. Reliable Automatic Sprinkler Co., Inc. (The).
2. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
3. Victaulic Company.
4. Viking Group Inc.

B. Standards:

1. UL 199 for standard automatic sprinklers.
2. FM 2000 for nonstorage application sprinklers.

C. Listed in UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."

D. Pressure Rating for Sprinklers:

1. Standard Automatic Sprinklers: 175 psig minimum.

E. Sprinklers, Automatic with Heat-Responsive Element, for wet pipe sprinkler systems:

1. Characteristics: Nominal 1/2 inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Sprinkler Finishes: As indicated in Part 3 "Application".

G. Special Coatings: As indicated in Part 3 "Application".

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards and Water Shields:

1. Manufacturers:
   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. SprinkGuard, LLC.
   c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   d. Victaulic Company.
   e. Viking Group Inc.
2. Standard: UL 199.
3. Description: Wire cage with fastening device for attaching to sprinkler.

J. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

K. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss cast in the sprinkler body.

PART 3 EXECUTION

3.01 APPLICATION

A. Piping Application:

1. Above Ground Piping between Fire Department Connections and Check Valves: Standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
2. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
3. Standard-pressure, wet-pipe fire protection system steel piping shall be one of the following:
   a. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   b. Schedule 40, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

B. Sprinkler Application:

1. Use sprinkler types in subparagraphs below for the following applications:
   a. Rooms without Ceilings: Upright, pendent and sidewall sprinklers as indicated.
   b. Rooms with Suspended Ceilings: Recessed pendent sprinklers.

c. Special Applications: Extended-coverage and quick-response sprinklers where indicated.

2. Provide sprinkler types in subparagraphs below with finishes indicated:
   a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces and locations not generally exposed to view.
   b. Recessed Sprinklers: Bright chrome on sprinkler and escutcheon.
   c. Flat Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

3.02 EXAMINATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Perform fire-hydrant flow test. Use results for system design calculations required.

1. Flow test is to be conducted in accordance with NFPA 291.
2. Test is to be performed during a period of ordinary demand for the water system.
   a. To obtain satisfactory test results of expected flow or rated capacities, sufficient discharge should be achieved to cause drop of at least 10 percent.
3. Pitot readings are to be taken at the 2-1/2 inch orifice connection.
4. The pitot reading is to range from 10 to 35 psig.
5. Open additional hydrant outlets as needed to control pitot readings.
6. The pitot pressure and corresponding residual pressure readings are to be taken consecutively as pressure fluctuates between a high number and low number.

B. Flow Test Data Written Report:

1. Flow data report is to be written in accordance with NFPA 291.
2. Flow data report is to include a copy of all flow data recorded during the test, including a site plan showing the tested fire hydrants with respect to the fire water service to the building. Site plan is to indicate which hydrant was flowed and which hydrant was used for pressure reading. Provide date of test, name of testing agency, and name of individual performing test.

C. Water Supply Curve: Provide water supply curve based on the lowest supply for a given set of test data. For a given residual pressure reading, the supply is to be graphed utilizing the corresponding pitot pressure/flow reading and static pressure reading.

D. Documentation is to include calibration certifications for gauges used in the flow tests. The certifications are to be from within the previous six (6) months from a reputable agency recognized for certifying pressure gauges.

E. Report flow test results promptly and in writing. A copy of the flow test data report is to be submitted with the hydraulic calculations.

3.04 INSTALLATION

A. Installation of Fire Protection Piping

1. Fire Protection Piping Installation:
   a. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
      1) Deviations from approved working plans for piping require written approval from AHJs. File written approval with Architect before deviating from approved working plans.
      2) Piping shall be installed with a minimum number of joints and couplings, but with adequate and accessible connections for disassembly, maintenance, and replacement of piping components. Pipe shall be reamed and deburred to remove any rough edges from the end of pipe. Piping joints and connections shall be assembled airtight and watertight.
      3) All piping, valves and devices shall be installed as high as possible, and shall not obstruct any portion of a window, doorway, stairway, or passageway, and shall not interfere with the operation or accessibility of any existing mechanical, plumbing or electrical equipment to the Owner’s satisfaction.
   b. General:
      1) Piping Standard: Comply with NFPA 13 requirements for installation of fire protection piping.
      2) Install pipe expansion joints or pipe expansion loops where piping crosses building expansion or movement joints in non-seismic applications.
      3) Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
      4) Install inspector's test connections in sprinkler system piping, complete with shutoff valve, and sized and located in accordance with NFPA 13 based on system type.
      5) Install fire-protection system piping with drains for complete system drainage. Extend drain piping to exterior of building when possible or open hub drain capable of accepting required flow rate without flooding.
      6) Install relief valve on every wet pipe sprinkler system. Relief valve shall not less than ½ inch in size and set to operate at 175 psi or 10 psi in excess of the maximum system pressure, whichever is greater.
      7) Provide air vent at top of sprinkler risers, standpipe risers, combination risers and drain risers.
      8) Provide air vent conforming to NFPA 13 requirements on each wet pipe system utilizing metallic pipe. Air vents shall be installed near a high point in the system. Where automatic relief vents are used, they shall be piped to the drain riser or other safe discharge location.
      9) Install wet-pipe sprinkler system control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
      10) Install automatic (ball drip) drain valve at each check valve for fire department connection, to drain piping between fire department connection and check valve. Install drain piping to and spill over floor drain or to exterior of building.

11) Install hangers and supports for fire-protection piping in accordance with NFPA standards. Comply with requirements for hanger materials in NFPA standards.
12) Install pressure gauges on riser or feed main, at each sprinkler test connection, at top of each standpipe/sprinkler riser and all other locations in accordance with NFPA standards. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they are not subject to freezing.
13) Fill wet-type fire-protection system piping with water.
14) Install sleeves for piping penetrations of walls, ceilings, and floors.
15) Install sleeve seals for piping penetrations of concrete walls and slabs.
16) Install escutcheons for piping penetrations of walls, ceilings, and floors.
17) The Contractor shall provide Owner approved, adequate permanent protection for any installed piping, valves, devices, or accessories which, in the Owner's opinion, are subject to physical damage.
18) Penetrations of ductwork shall not be permissible.
19) Fire-protection system piping shall not pass-through hazardous areas and shall be located so that it is protected from mechanical and fire damage.
20) Install a NPS 3 grooved capped inlet on the NPS 3 drain riser(s) to allow testing of the pressure regulating hose valve(s).
21) Pooling of cutting oil or other petroleum-based products in the sprinklers must be avoided. Always cut and thread pipe without the sprinkler being attached and always be sure to check and drain the drops of any excessive oil prior to the installation of sprinklers.
22) Provide a minimum clearance of 12 inches under bottom of fire-protection piping above suspended ceiling for lighting to be installed.
23) Route fire-protection piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
24) Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
25) No fire-protection system piping shall be installed inside of electrical equipment rooms except for sprinkler branch line piping serving sprinklers within the same electrical room, and all such branch line piping shall dead end within the electrical equipment room. Avoid routing sprinkler system piping and installing sprinkler heads directly over electrical equipment. Reroute piping and add additional sprinklers as required to avoid sprinklers and pipe installed directly over electrical equipment.

c. Piping Joint Installation:
1) Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
2) Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3) Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

4) Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   (a) Apply appropriate tape or thread compound to external pipe threads.
   (b) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
5) Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe in accordance with AWWA C606 in accordance with the manufacturer's latest published instructions. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints. 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. The 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.
6) Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
7) Rubber gasketed pipe fittings and couplings shall not be installed where ambient temperatures can be expected to exceed 150 degrees Fahrenheit unless listed for this service.
8) A one-piece reducing fitting shall be used wherever a change is made in the size of pipe.
9) Do not use couplings to provide support point for vertical piping.
10) All grooved mechanical couplings, fittings and gaskets shall be of the same manufacturer.

2. Valves and Specialties Installation:
   a. Install listed Fire-Protection system control valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with manufacturer's installation instructions, NFPA standards, and Authorities Having Jurisdiction.
   b. Air Vent:
      1) Provide at least one air vent at high point in each wet-pipe fire-Protection system in accordance with NFPA standards. Connect vent into top of fire-Protection piping.
      2) Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
      3) For automatic air vents, pipe from outlet of air vent to drain.
   c. Provide drain valves at main shutoff valves, low points of piping and trapped portions of piping per NFPA 13 based on system type.
3. Sprinkler Installation:
   a. Install sprinklers in accordance with their listing.
   b. Unless otherwise indicated, all sprinklers shall be arranged symmetrically within each room or space. All sprinklers to be installed in suspended ceilings of any type shall be aligned and shall be located as indicated on the architectural reflected ceiling plans or fire protection plans. In areas without a suspended ceiling, install sprinkler piping as high as possible.

c. The sprinkler deflector distance for recessed pendent or flush pendent sprinklers below the suspended ceiling shall be consistent.

d. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, soffits, ceiling and elevation changes and partition assemblies.

e. Coordinate layout and installation of sprinklers in exposed construction areas with structural elements and work of other trades.

f. Placement of sprinklers shall comply with NFPA 13 obstruction rules.

g. Do not install sprinklers that have been dropped, damaged, show a visible loss of fluid, or a cracked bulb.

h. The sprinkler bulb protector shall be removable by hand, without tools or devices that may damage the bulb.

i. Install sprinklers in suspended ceilings symmetrically in center of narrow dimension of acoustical ceiling panels within tolerance of 1/2 inch. Coordinate entire pattern of sprinkler locations with approved reflected ceiling plan.

j. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Install dry pendent sprinklers in tee fitting. The minimum length between the sprinklers and fittings shall be in accordance with the manufacturer’s instructions.

k. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

l. Horizontal sidewall sprinklers shall not be installed back-to-back in residential occupancies. Provide a minimum of 6 inch horizontal separation to reduce sound transmission.

m. Horizontal sidewall, standard response, intermediate temperature rated sprinklers shall be installed at the bottom of each elevator hoist-way. Sprinklers at the bottom of hoist-way shall not be more than 2 feet above the floor of the pit. Provide a supervised dedicated shut off valve and water-flow switch in the supply feeding the sprinklers in each elevator pit.

n. Upright or pendent standard response, intermediate temperature rated sprinklers shall be installed in the elevator hoist-ways and machine rooms. Provide a dedicated supervised shutoff valve and water-flow switch in the supply feeding the sprinklers in each elevator machine room and at the top of each elevator shaft.

o. Sprinklers shall be installed under fixed obstructions or grouped obstruction over 4 feet or as required by NFPA 13 obstruction rules.

p. Sprinklers installed below 7 feet above finished floor in areas having exposed construction shall be provided with head guards.

q. Positioning of sprinkler deflector under ceiling, metal deck or slab shall conform to the requirements of NFPA 13. Deflector of sprinklers shall be aligned parallel to ceiling or roof.

r. Provide sprinkler protection in the accessible vertical shaft and/or around vertical opening if the vertical opening(s) are not protected by fire rated enclosure.

s. Protective caps and straps shall be removed from all sprinklers prior to the time when the sprinkler system is placed in service.

t. A minimum of 18-inch clearance shall be maintained between top of storage and ceiling sprinkler deflector.

u. Sprinklers having both a K-factor exceeding 5.6 and having ½ inch national standard threads shall not be installed.

v. Sprinklers shall be designed to open at temperature from 135 deg F to 165 deg F in locations where the ceiling temperature does not exceed 100 deg F. Where the ceiling temperature exceeds 100 deg F, the temperature rating of sprinklers shall be in accordance with NFPA 13. Comply with NFPA 13 for alternate sprinkler temperature requirements based on proximity to heat sources, etc.

3.05 FIELD TESTING

A. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect fire-protection systems in accordance with NFPA standards.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that sprinklers original factory finish has not been contaminated with dirt, debris, or paint. Sprinklers containing other-than-original factory finish are to be considered defective and replaced with new products. Repair and/or cleaning is not acceptable.

B. The installer shall perform all the required acceptance tests per the provisions of applicable sections of NFPA standards, complete the contractor's Material and Test Certificate(s), forward the certificates to the authority having jurisdictions prior to asking approval for installation. Contractor shall give advance notification of the time and date the testing will be performed.

C. All fire-protection system piping shall be tested hydrostatically at not less than 200 psig minimum pressure for 2 hours, except when the system pressure is more than 150 psig, then all fire protection system piping shall be tested at a pressure of 50 psig more than the maximum system working pressure for two (2) hours. The test pressure shall be read from a gauge located at the low elevation point of the system being tested. If weather does not permit testing system with water, an interim test may be conducted with air pressure of at least 40 psig allowed to stand for 24 hours with no leakage more than 1.5 psig. The standard hydrostatic test shall be conducted when weather permits.

1. Additives, corrosive chemicals such as sodium silicate or derivative of sodium silicate brine or other chemicals shall not be used for stopping leaks while hydrostatically testing systems. However, use of biocides and other chemicals that are approved and used for prevention and mitigation of MIC and that do not adversely affect the fire-fighting properties are permitted.
2. Submit contractors and material test certificates signed by installing contractor and owner's representative in accordance with NFPA standards.

D. There shall be no visible leakage when the fire-protection systems are subjected to the hydrostatic pressure test.

E. The main drain valve shall be opened and remain open until the system pressure stabilizes. The static and residual pressures shall be recorded on the contractor's test certificate.

F. Water flow detecting devices, including the associated alarm circuits, shall be tested by an actual water flow through use of a test connection.

G. Fire-protection systems shall be considered defective if it does not pass tests and inspections.

H. Fire-protection system components considered defective during testing will be replaced with new components. Repair of defective components is not acceptable.

I. Prepare test and inspection reports.

3.06 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping in accordance with requirements for identification specified in Section 210500 "Common Work Results for Fire Protection".

B. Install valve tags on valves in accordance with requirements for identification specified in Section 210500 "Common Work Results for Fire Protection".

C. Identify system components, wiring, cabling, and terminals.

3.07 CLEANING

A. Clean dirt and debris from fire-protection system piping, system control valves, sprinklers, and associated components.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

C. Remove tape and other temporary coverings used to protect sprinklers.

END OF SECTION 211000

SECTION 220000 - GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

END OF SECTION 220000

SECTION 220800 - COMMISSIONING OF PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes Cx process requirements for the following plumbing systems, assemblies, and equipment:

1. Functionally tested by CxA:
    a. Mixing Valves
    b. Vacuum Pumps
    c. Pure Water System
    d. Flow Fixtures
2. Observe construction, witness testing by others, and collect documentation:
    a. Eyewash Stations
    b. Safety Stations
    c. Bunsen Burners

B. Related Requirements:

a. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
b. For construction checklists, comply with requirements in various Division 22 Sections specifying plumbing systems, system components, equipment, and products.

1.02 DEFINITIONS

A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

C. IAPMO: International Association of Plumbing and Mechanical Officials.

D. IgCC: International Green Construction Code.

E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.03 INFORMATIONAL SUBMITTALS

A. Construction Checklists:

a. Draft Cx plan, including draft construction checklists to be prepared by CxA under Section 019113 "General Commissioning Requirements." Contractor is to review Construction Checklist in accordance with requirements in Section 019113 "General Commissioning Requirements" and ASHRAE 202 and to resolve any issues with the CxA.

B. Test Equipment and Instruments: For all test equipment and instruments to be used in conducting Cx tests by Contractor, provide the following:

a. Equipment/instrument identification number.
b. Planned Cx application or use.
c. Manufacturer, make, model, and serial number.
d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
e. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:
1) Instrument or tool identification number.
2) Equipment schedule designation of equipment for which the instrument or tool is required.
3) Manufacturer, make, model, and serial number.
4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.04 QUALITY ASSURANCE

A. Plumbing Testing Technician Qualifications: Technicians to perform plumbing Construction Checklist verification tests. Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

a. Journey level or equivalent skill level with knowledge of plumbing system, electrical concepts, and building operations.
b. Minimum three years' experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Testing Equipment and Instrumentation Quality and Calibration:

a. Capable of testing and measuring performance within the specified acceptance criteria.
b. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
c. Be maintained in good repair and operating condition throughout duration of use on Project.
d. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

C. Proprietary Test Instrumentation and Tools:

a. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:
   1) Be calibrated by manufacturer with current calibration tags permanently affixed.
   2) Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
   3) Plumbing system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CX PROCESS

A. Perform Cx process for plumbing systems in accordance with:

   a. ASHRAE 202.

3.02 CONSTRUCTION CHECKLISTS

A. Preliminary detailed construction checklists are to be prepared under Section 019113 "General Commissioning Requirements" for each plumbing system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in ASHRAE 202. Contractor performs the following:

   a. Review plumbing preliminary construction checklists and provide written comments on Construction Checklist items where appropriate.
   b. Return preliminary Construction Checklist with review comments within 10 days of receipt.
   c. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
   d. Use only construction checklists marked "Approved for Use, (date)." Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.

END OF SECTION 220800

SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Domestic Water Piping

1. Copper Tube and Fittings.
2. Transition Fittings.
3. Flexible Connectors.

B. Sanitary Waste and Vent Piping

1. Copper Tube and Fittings.
2. Stainless-Steel Pipe and Fittings.
3. PVC Pipe and Fittings.
4. Hub-and-Spigot, Cast-iron Soil Pipe and Fittings.
5. Hubless, Cast-iron Soil Pipe and Fittings.
6. Transition Fittings.
7. Dielectric Fittings.

C. Storm Drainage Piping

1. Hubless, cast-iron soil pipe and fittings.
2. Transition Fittings.
3. Dielectric Fittings.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 PERFORMANCE REQUIREMENTS

A. Domestic Water Piping

1. Domestic water piping, tubing,fittings, andappurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Sanitary Waste and Vent Piping

1. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   a. Soil, Waste, and Vent Piping: 10-foot head of water.
   b. Waste, Force-Main Piping: 50 psig.
2. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of eathquake motions determined according to ASCE/SEI 7. See Division 20 Section "Vibration and Seismic Controls for Piping and Equipment.":
   a. The term "withstand" means "the unitl will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
3. Seismic Performance: Storm drainage piping and support and installation to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7. See Division 20 Section "Vibration and Seismic Controls for Piping and Equipment."
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
   b. Component Importance Factor: 1.5.

C. Storm Drainage Piping

1. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   a. Storm Drainage Piping: 10-foot head of water (30 kPa).
   b. Storm Drainage, Force-Main Piping: 50 psig.
2. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.04 SUBMITTALS

A. Action Submittals

1. Product Data:
   a. Pipe and tube.
   b. Fittings.
   c. Joining materials.
   d. Transition fittings.
2. Installers of pressure-sealed joints shall submit proof of manufacturer certification for installation of pressure-sealed joints.

3. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.
4. Shop Drawings: For Sovent drainage system. Include plans, elevations, sections, and details.
5. Shop Drawings: For controlled-flow or siphonic roof drainage system. Include calculations, plans, and details.

B. Informational Submittals

1. Coordination Drawings: Plans and elevations or Building Information Model (BIM) as indicated in Division 01 drawn to scale, showing items described in this Section and coordinated with all building trades.
2. Coordination Drawings: Detail sanitary, waste, and storm drainage piping. Show support locations, type of support, weight on each support, required clearances, 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:
   a. Structural members to which drainage piping will be attached or suspended from.
3. System purging and disinfecting activities report.
4. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
5. Field Quality-Control Reports: Inspection reports signed by authorities having jurisdiction.

C. LEED Submittals

1. Sustainable Design Submittals:
   a. Product Data: For solvent cements, adhesive primers, and adhesives, indicating VOC content.
   b. Laboratory Test Reports:For solvent cements, adhesive primers, and adhesives, documentation indicating that productscomply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers

1.05 WARRANTIES

A. Listed manufacturers to provide labeling and warranty of their respective products.

1.06 QUALITY ASSURANCE

A. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

B. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

C. Installer Qualifications: Installers of pressure-sealed joints are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

D. Piping materials shall bear label, stamp, or other markings of specified testing agency.

E. Each pipe shall be marked with manufacturer's name or registered trademark, county of origin, and date of manufacture.

F. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

1.07 DELIVERY, STORAGE AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

C. Follow Project Location recommendations for storage.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

B. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Bid Opening Time no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Bid Opening Time 's written permission.

C. Interruption of Existing Sanitary Waste Service: Do not interrupt service facilities occupied by Client or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Bid Opening Time no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not interrupt sanitary waste service without Bid Opening Time 's written permission.

D. 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 according to requirements indicated:

1. Notify Bid Opening Time no fewer than two days in advance of proposed interruption of storm drainage service.
2. Do not proceed with interruption of storm drainage service without Bid Opening Time 's written permission.

PART 2 PRODUCTS

2.01 GENERAL

A. Piping Materials

1. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
2. Potable-water piping and components shall comply with NSF 14, NSF 61 and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.02 DOMESTIC WATER PIPING

A. Copper Tube and Fittings

1. Drawn-Temper "Hard" Copper Tube: ASTM B88 , Type L water tube.
2. Wrought-Copper, Solder-Joint Fittings: {RS#367}, pressure fittings. Do not use solder joints on pipe sizes greater than NPS 3.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than NPS 3.

B. Transition Fittings

1. General Requirements:
   a. Same size as pipes to be joined.
   b. Pressure rating at least equal to pipes to be joined.
   c. End connections compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   1) NIBCO Inc.

C. Dielectric Fittings

1. Comply with the requirements of Division 20 Section 200500 “Common Work Results.”
2. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
3. Comply with requirements in Division 22 Section "Plumbing Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
4. Dielectric Unions:
   a. Standard: ASSE 1079.
   b. Pressure Rating: 150 psig .
   c. End Connections: Solder-joint copper alloy and threaded ferrous.
5. Dielectric Flanges:
   a. Standard: ASSE 1079.
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).

d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

6. Dielectric-Flange Insulating Kits:
   a. Nonconducting materials for field assembly of companion flanges.
   b. Pressure Rating: 150 psig .
   c. Gasket: Neoprene or phenolic.
   d. Bolt Sleeves: Phenolic or polyethylene.
   e. Washers: Phenolic with steel backing washers.
7. Dielectric Nipples:
   a. Standard: IAPMO PS 66.
   b. Electroplated steel nipple complying with ASTM F1545.
   c. Pressure Rating and Temperature:300 psig at 225 deg F .
   d. End Connections: Male threaded or grooved.
   e. Lining: Inert and noncorrosive, propylene.

D. Flexible Connectors

1. Manufacturers:
   a. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Metraflex, Inc.
   d. Proco Products, Inc.
2. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   a. Working-Pressure Rating: Minimum 200 psig.
   b. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   c. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.03 SANITARY WASTE AND VENT PIPING

A. Copper Tube and Fittings

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
2. Solder: ASTM B32, lead free with ASTM B813, water-flushable flux.

B. PVC Pipe and Fittings

1. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
2. Solid-Wall PVC Pipe: ASTM D2665, drain, waste, and vent.
3. PVC Socket Fittings: ASTM D2665, made to ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
4. Adhesive Primer: ASTM F656.

a. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

5. Solvent Cement: ASTM D2564.
   a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings

1. Pipe and Fittings: ASTM A74, Service and Extra Heavy class(es). All pipe and fittings shall be marked with Project Location's name or Registered Trademark, country of origin, and date of manufacture. Pipe and fittings shall also bear the mark of the National Sanitation Foundaiton
2. Gaskets: ASTM C564, rubber.
3. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.
4. Tensile Strength: 21,000 psig mi
5. Each length of pipe and each fitting shal be plainly marked with size, sountry of origin, and name of Project Location, or Project Location's registered trademark by which the Project Location can be readily identified afterinstallation.

D. Hubless, Cast-Iron Soil Pipe and Fittings

1. Pipe and Fittings: ASTM A888 and CISPI 301 All pipe and fittings shall be marked with manufacturer's name or Registered Trademark, country of origin, and date of manufacture. Pipe and fittings shall also bear the mark of the National Sanitation Foundaiton
   a. Tensile Strength: 21,000
   b. Each length of pipe and each fitting shal be plainly marked with size, sountry of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified afterinstallation.
2. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
   a. Manufacturers:
      1) Conine Manufacturing Co., Inc.
      2) SE Sovent.
3. Heavy-Duty, Hubless-Piping Couplings:
   a. Manufacturers:
      1) ANACO-Husky.
      2) Charlotte Pipe and Foundry Company.
      3) Clamp-All Corp.

4) MIFAB, Inc.

b. Standards: ASTM C1277 and ASTM C1540.

c. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

1) ANACO-Husky.

2) Charlotte Pipe and Foundry Company.

3) Mission Rubber Company, LLC; a division of MCP Industries.

4) Mifab.

E. Transition Fittings

1. Transition Couplings:

a. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

b. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

c. Unshielded, Nonpressure Transition Couplings:

1) Manufacturers:

(a) Fernco Inc.

(b) Froet Industries LLC.

(c) Mission Rubber Company; a division of MCP Industries, Inc.

2) Standard: ASTM C1173.

3) Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

(a) Froet Industries LLC.

4) Sleeve Materials:

(a) For Cast-Iron Soil Pipes: ASTM C564, rubber.

(b) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

(c) For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

d. Shielded, Nonpressure Transition Couplings:

1) Manufacturers:

(a) Fernco Inc.

(b) Froet Industries LLC.

(c) Mission Rubber Company; a division of MCP Industries, Inc.

2) Standard: ASTM C1460.

3) Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

4) End Connections: Same size as and compatible with pipes to be joined.

F. Dielectric Fittings

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Flanges:
    a. Description:
        1) Standard: ASSE 1079.
        2) Factory-fabricated, bolted, companion-flange assembly.
        3) Pressure Rating: 300 psig.
        4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.04 STORM DRAINAGE PIPING

A. Hubless, Cast-Iron Soil Pipe and Fittings

1. Pipe and Fittings: ASTM A888 and CISPI 301 stamped with the Cast Iron Soil Pipe Institute trademark. Pipe shall be cast vertically or by centrifugal process and the inside and outside diameters shall be concentric, smooth, and free from cracks, sand holes, and other defects.
2. Heavy-Duty, Hubless-Piping Couplings:
    a. Manufacturers:
        1) Charlotte Pipe and Foundry Company.
        2) Ideal Clamp Products.
        3) MIFAB, Inc.
    b. Standards: ASTM C1540.
    c. Description: Stainless-steel shield with a minimum of four stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

PART 3 EXECUTION

3.01 INSTALLATION

A. Domestic Water Piping

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
2. Install piping as tight to underside of structure or as coordinated prior to installation with all other trades dictated by the general or prime contractor.
3. Unless approved by a registered and licensed structural engineer, building structure shall not be cut, drilled, notched, spliced or altered in any way.
4. Copper Tubing
    a. Install copper tubing under building slab according to CDA's "Copper Tube Handbook." All under slab piping shall be Annealed Type K copper with no soldered joints.

5. Install shutoff valve immediately upstream of each dielectric fitting.
6. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 Section "Plumbing Piping Specialties."
7. Install domestic water piping level without pitch and plumb.
8. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
9. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
10. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
11. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
12. Install piping to permit valve servicing.
13. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
14. Install piping free of sags and bends.
15. Install fittings for changes in direction and branch connections.
16. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
17. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping."
    a. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 Section 22 11 23 "Domestic Water Pumps."
    b. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Division 22 Section 22 05 19 "Meters and Gages for Plumbing Piping."
    c. Install sleeves for piping penetrations of walls, ceilings, and floors.
    d. Install sleeve seals for piping penetrations of concrete walls and slabs.
    e. Install escutcheons for piping penetrations of walls, ceilings, and floors.
    f. Install branch connections to mains using tee fittings in main pipe.
18. Transition Fittings
    a. Install transition couplings at joints of dissimilar piping.
    b. Transition Fittings in Underground Domestic Water Piping:
        1) Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
        2) Fittings for NPS 2 and Larger: Sleeve-type coupling.
    c. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.
19. Dielectric Fittings
    a. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
    b. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
    c. Dielectric Fittings for NPS 2-1/2 to NPS 4 : Use dielectric flanges or nipples.

d. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

20. Flexible Connectors
    a. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
    b. Install bronze-hose flexible connectors in copper domestic water tubing.
    c. Install stainless-steel-hose flexible connectors in steel domestic water piping.
21. Hangers and Supports
    a. Comply with requirements for seismic-restraint devices in Division 20 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
    b. Comply with requirements for pipe hanger, support products, and installation in Division 20 Section "Hangers and Supports for Piping and Equipment."
    c. Support vertical piping and tubing at base and at each floor, or as required by prevailing code if such code is more stringent.
    d. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch .
    e. Install hangers for copper tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
    f. Support horizontal piping within 12 inches of each fitting.
    g. Support vertical runs of copper tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
    h. Support piping and tubing not listed in this article according to MSS SP-58 and Project Location's written instructions.
22. Escutcheons
    a. Install escutcheons for penetrations of walls, ceilings, and floors.
    b. Comply with the requirements of Division 20 Section 200500 “Common Work Results.”
    c. Escutcheons for New Piping:
    d. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
    g. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
    h. Bare Piping in Equipment Rooms: One piece, cast brass.
    i. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.
23. Joint Construction
    a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
    b. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

c. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1) Apply appropriate tape or thread compound to external pipe threads.
   2) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
d. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
e. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
f. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer. Leave insertion marks on pipe after assembly.
g. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
h. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
i. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

24. Valves
   a. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
   b. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures or groups of plumbing fixtures within the same room. Use ball or gate valves for piping NPS 2 and smaller. Use gate valves for piping NPS 2-1/2 and larger.
      1) Install shutoff valve on each water supply serving each patient room per IDPH requirements.
   c. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
      1) Hose-End Drain Valves: At low points in water mains, risers, and branches.
      2) Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
   d. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves. Balancing valve assembly to include shutoff valve, check valve and balancing valve.

e. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves. Balancing valve assembly to include shutoff valve, check valve and balancing valve.

B. Sanitary Waste and Vent Piping

1. Unless approved by a registered and licensed structural engineer, building structure shall not be cut, drilled, notched, spliced or altered in any way.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   a. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   b. Install piping as indicated unless deviations to layout are approved on coordination drawings.
3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping to permit valve servicing.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
11. Install piping and support devices to allow application of insulation.
12. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
    a. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
    b. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
       1) Straight tees, elbows, and crosses may be used on vent lines.
    c. Do not change direction of flow more than 90 degrees.
    d. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
       1) Reducing size of waste piping in direction of flow is prohibited.
13. Lay buried building waste piping beginning at low point of each system.
    a. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
    b. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
    c. Maintain swab in piping and pull past each joint as completed.

14. Install soil and waste drainage and vent piping at the minimum slopes required by code.
15. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
    a. Install encasement on underground piping according to ASTM A674 or AWWA C105/A21.5
16. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
17. Install force mains at elevations indicated.
18. Plumbing Specialties:
    a. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping.
    b. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Plumbing Piping Specialties."
    c. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Plumbing Piping Specialties."
19. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
20. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section Division 20 Section "Common Work Results for Mechanical."
21. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 20 Section "Common Work Results for Mechanical."
22. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 20 Section "Common Work Results for Mechanical."
23. Every vent stack shall connect to the base of the drainage stack at or below the lowest horizontal branch.
24. Horizontal offsets of drainage stacks shall be vented where 5 or more branch internals are located above the offset. The upper and lower sections of the drainage stack shall be vented and sized per code.
25. Branch vents must rise 6” above the flood level rim of the fixture being vented.
26. All vent terminations shall be a minimum of 12” above the roof, or 7 feet above any occupied roof area.
27. Vent through roofs shall be a minimum of 4” for frost protection.
28. Soil and waste stacks in buildings having more than 10 branch intervals shall be provided with a full size relief vent at each tenth interval installed, beginning with the top floor.
29. All indirect waste shall be a minimum of 1” unless otherwise noted on drawing.
30. All sanitary offsets shall be vented per local authority.
31. Hangers and Supports
    a. Comply with requirements for pipe hanger and support devices and installation specified in Division 20 Section "Hangers and Supports for Piping and Equipment."
        1) Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
        2) Install stainless-steel pipe hangers for horizontal piping in corrosive environments.

3) Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4) Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5) Vertical Piping: MSS Type 8 or Type 42, clamps.
6) Install individual, straight, horizontal piping runs:
   (a) 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   (b) Longer Than 100 Feet : MSS Type 43, adjustable roller hangers.
7) Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8) Base of Vertical Piping: MSS Type 52, spring hanger

b. Support horizontal piping and tubing within 12 inches of each fitting, valve and coupling.
c. Support vertical piping and tubing at base and at each floor.
d. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
e. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent (1500 mm).
f. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Storm Drainage Piping

1. Unless approved by a registered and licensed structural engineer, building structure shall not be cut, drilled, notched, spliced or altered in any way.
2. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
4. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
6. Install piping at indicated slopes.
7. Install piping free of sags and bends.
8. Install fittings for changes in direction and branch connections.
9. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
10. Install piping to allow application of insulation.
11. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
    a. Do not change direction of flow more than 90 degrees.

b. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
c. Reducing size of drainage piping in direction of flow is prohibited.

12. Lay buried building piping beginning at low point of each system.
    a. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
    b. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
    c. Maintain swab in piping and pull past each joint as completed.
13. Install storm drainage piping at the minimum slopes required by code.
14. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
    a. Install encasement on underground piping according to ASTM A674 or AWWA C105/A21.5.
15. Plumbing Specialties:
    a. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.
    b. Comply with requirements for cleanouts specified in Division 22 Section 22 14 23 "Storm Drainage Piping Specialties."
16. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
17. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 20 Section 20 05 13 "Common Work Results."
18. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 20 Section 20 05 13 "Common Work Results."
19. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 20 Section 20 05 13 "Common Work Results."
20. Hangers and Supports
    a. Comply with requirements for pipe hanger and support devices and installation specified in Division 20 Section "Hangers and Supports for Piping and Equipment."
        1) Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
        2) Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
        3) Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
        4) Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
        5) Vertical Piping: MSS Type 8 or Type 42, clamps.
        6) Individual, Straight, Horizontal Piping Runs:
        7) 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
        8) Longer Than 100 Feet : MSS Type 43, adjustable roller hangers.

9) Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
10) Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
11) Base of Vertical Piping: MSS Type 52, spring hangers.

b. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
c. Support vertical piping and tubing at base and at each floor.
d. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
e. Install hangers for cast-iron soil tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
f. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
g. Support vertical cast-iron tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.
h. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

21. Joint Construction
a. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.02 CONNECTIONS

A. Domestic Water Piping

1. Drawings indicate general arrangement of piping, fittings, and specialties.
2. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
3. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
4. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
a. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
b. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
c. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
d. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

B. Sanitary Waste and Vent Piping

1. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
3. Connect drainage and vent piping to the following:
4. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
    a. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
    b. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
    c. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
    d. Install horizontal backwater valves with cleanout cover flush with floor.
    e. Comply with requirements for backwater valves, cleanouts, and drains specified in Division 22 Section "Plumbing Piping Specialties."
    f. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
5. Connect force-main piping to the following:
    a. Sanitary Sewer: To exterior force main.
    b. Sewage Pump: To sewage pump discharge.
6. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
7. Make connections according to the following unless otherwise indicated:
    a. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
    b. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

C. Storm Drainage Piping

1. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
3. Connect storm drainage piping to roof drains and storm drainage specialties.
    a. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
4. Comply with requirements for cleanouts and drains specified in Division 22 Section "Plumbing Piping Specialties."
5. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
6. Make connections according to the following unless otherwise indicated:
7. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
    a. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.03 FIELD TESTING

A. Domestic Water Piping

1. Perform the following tests and inspections:
   a. Piping Inspections:
      1) Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      2) During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
         (a) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
         (b) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
      3) Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
      4) Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
   b. Piping Tests:
      1) Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
      2) Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
      3) Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
      4) Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
      5) Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
      6) Prepare reports for tests and for corrective action required.
2. Copper Pipe Press Fittings
   a. Copper pipe joined with pressure fit fittings shall be in accordance with the manufacturer’s installation instructions. Obtain any required Viega or NIBCO certified training to successfully meet these requirements at no extra cost to the project. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to ensure the tubing is fully engaged (inserted) into the fitting. The joints shall be pressed using the tool approved by the manufacturer.

b. Contractor shall have a pipe fitting procedure in place to distinctly identify each individual's pipe connection. Each individual pipe fitter must identify their pipe connection with an approved identification marking (ie. colored electrical tape or initialed pipe connections, etc.)

3. Domestic water piping will be considered defective if it does not pass tests and inspections.
4. Prepare test and inspection reports.
   a. Perform final testing in presence of owner or owner's representative
   b. Prepare reports for tests and for corrective action required.
   c. Provide owner documentation indicating successful testing is completed.

B. Sanitary Waste and Vent Piping

1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
2. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
4. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   b. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   c. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   d. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg . Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
   e. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   f. Perform final testing in presence of owner or owner's representative
   g. Prepare reports for tests and for corrective action required.

h. Provide owner documentation indicating successful testing is completed.

5. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   a. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   b. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   c. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   d. Perform final testing in presence of owner or owner's representative
   e. Prepare reports for tests and for corrective action required.
   f. Provide owner documentation indicating successful testing is completed.

C. Storm Drainage Piping

1. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
2. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   b. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   c. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
   d. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   e. Prepare reports for tests and required corrective action.
3. Piping will be considered defective if it does not pass tests and inspections.

3.04 IDENTIFICATION

A. Domestic Water Piping

1. Identify system components. Comply with requirements for identification materials and installation in Division 20 Section "Mechanical Identification."
2. Label pressure piping with system operating pressure.

B. Sanitary Waste and Vent Piping

1. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 20 Section 200553 "Mechanical Identification."

C. Storm Drainage Piping

1. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 20 Section 200553 "Mechanical Identification."

3.05 ADJUSTING

A. Domestic Water Piping

1. Perform the following adjustments before operation:
   a. Close drain valves, hydrants, and hose bibbs.
   b. Open shutoff valves to fully open position.
   c. Open throttling valves to proper setting.
   d. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
      1) Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
      2) Adjust calibrated balancing valves to flows indicated.
   e. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   f. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   g. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   h. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.06 CLEANING

A. Domestic Water Piping

1. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
2. Clean and disinfect potable domestic water piping as follows:
   a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   b. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

1) Flush piping system with clean, potable water until dirty water does not appear at outlets.
2) Fill and isolate system according to either of the following:
   (a) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
   (b) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   1) Submit water samples in sterile bottles to authorities having jurisdiction.
   2) Repeat procedures if biological examination shows contamination.

B. Sanitary Waste and Vent Piping

1. Clean interior of piping. Remove dirt and debris as work progresses.
2. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
3. Place plugs in ends of uncompleted piping at end of day and when work stops.
4. Repair damage to adjacent materials caused by waste and vent piping installation.

C. Storm Drainage Piping

1. Clean interior of piping. Remove dirt and debris as work progresses.
2. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
3. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.07 EARTHWORK

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving." At minimum, backfill shall be free from discarded construction material and debris. Loose earth, free from rocks, broken concrete, frozen chunks and other rubble, shall be placed in the trench in 6-inch layers and tamped in place until the crown of the pipe is covered by 12 inches of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned.

B. In instances where the manufacturer's installation instructions are more restrictive than those prescribed by the paragraph above, the material shall be installed in accordance with the more restrictive requirement.

C. Unless approved by a registered and licensed structural engineer, trenching installed parallel to footings shall not extend into the bearing plane of a footing or wall. The upper boundary of the bearing plane is a line that extends downward, at an angle of 45 degrees (0.79 rad) from horizontal, from the outside bottom of the footing or wall.

3.08 PIPING SCHEDULE

A. Domestic Water Piping

1. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
2. Flanges and unions may be used for aboveground piping joints only unless otherwise indicated.
3. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
4. Only, and must be formed and pressure tested off-site prior ro project installation.
5. Water service entry, domestic water, building-service piping, shall be the following:
6. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
    a. Hard copper tube, ASTM B88, Type L (ASTM B88M, Type B); cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.
    b. Hard copper tube, ASTM B88, Type L (ASTM B88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints based upon satisfactory compliance with above sections governing the use if Viega Pro-Press as an alternate.
7. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 , shall be one of the following:
    a. Hard copper tube, ASTM B88, Type L (ASTM B88M, Type B); cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.

B. Sanitary Waste and Vent Piping

1. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
2. Underground, soil, waste, and vent piping shall be any of the following:
3. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
    a. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; CISPI hubless-piping couplings; and coupled joints.
    b. Copper Type M tube, copper drainage fittings, and soldered joints.
4. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
    a. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
    b. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
    c. Dissimilar Pipe-Material Couplings: Transition couplings and/or dielectric fittings as scheduled above.
5. Above ground, vent piping NPS 4 and smaller shall be any of the following:
    a. Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints (2-1/2” or less only).
    b. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
6. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:
    a. Hard copper tube, Type L (Type B); wrought-copper pressure fittings; and soldered joints.
7. Aboveground sanitary-sewage force mainsNPS 2-1/2 to NPS 6 shall be any of the following:

a. Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
b. Galvanized-steel pipe, pressure fittings, and threaded joints.
c. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

C. Storm Drainage Piping

1. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
2. Refer to “Plumbing Piping System Application Schedule” in drawings.
3. Above and underground storm drainage piping shall be the following:
   a. Hubless, cast-iron soil pipe and fittings; heavy-duty CISPI hubless-piping couplings; and coupled joints.

3.09 VALVE SCHEDULE

A. Domestic Water Piping

1. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   a. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
   b. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
   c. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
   d. Drain Duty: Hose-end drain valves.
2. Use check valves to maintain correct direction of domestic water flow to and from equipment.
3. Provide check valve on branch piping downstream of hot water circulation balancing valve.
4. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221005

SECTION 221006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Domestic Water Piping Specialties

1. Vacuum Breakers.
2. Mechanical Balancing Valves.
3. Temperature-Actuated, Water Mixing Valves.
4. Strainers.
5. Hose Bibbs.
6. Water-Hammer Arresters.
7. Air Vents.

B. Sanitary Waste Piping Specialties

1. Cleanouts.
2. Floor Drains.
3. Floor Sinks.
4. Air-Admittance Valves.
5. Miscellaneous sanitary drainage piping specialties.

C. Storm Drainage Piping Specialties

1. Cleanouts.
2. Through-Penetration Firestop Assemblies.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Division 22 "Emergency Plumbing Fixtures" for water tempering equipment.

1.04 PERFORMANCE REQUIREMENTS

A. Domestic Water Piping Specialties

1. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.05 SUBMITTALS

A. Action Submittals

1. Product Data: For each type of product. include rated capacities, operating characteristics, and accessories for the following:
2. Shop Drawings: For domestic water piping specialties.

B. Closeout Submittals

1. Field quality-control reports.

C. LEED Submittals

1. Sustainable Design Submittals: "Product Data" Subparagraph below applies to LEED 2009, LEED v4, IgCC, ASHRAE Std 189.1, and Green Globes for fixtures and equipment that consume water.
   a. Product Data: For water consumption.

D. Operation and Maintenance Materials

1. For domestic water piping specialties to include in emergency, operation, and maintenance manuals.
2. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

E. Record Documents

1. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

1.06 QUALITY ASSURANCE

A. 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.

B. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.08 EXTRA MATERIALS

A. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

PART 2 PRODUCTS

2.01 GENERAL

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. For plastic components: NSF 14, mark "NSF-pw" on plastic piping components.

C. Source Limitations

1. Obtain each type of specialty from single source and from a single manufacturer. Coordinate products across all applicable size ranges to be from the same manufacturer.

2.02 DOMESTIC WATER PIPING SPECIALTIES

A. Mechanical Balancing Valves

1. Copper-Alloy Calibrated Balancing Valves:
   a. Type: Ball valve with two readout ports and memory-setting indicator.
   b. Body: Lead free brass or bronze.
   c. Size: Same as connected piping, but not larger than NPS 2.
   d. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Temperature-Actuated, Water Mixing Valves

1. Water-Temperature Limiting Devices (Point of use):
   a. Standard: ASSE 1070.
   b. Pressure Rating: 125 psig .
   c. Type: Thermostatically controlled, water mixing valve.
   d. Material: Bronze body with corrosion-resistant interior components.
   e. Connections: Threaded union inlets and outlet.
   f. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
2. Individual-Fixture, Water Tempering Valves:

a. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
b. Pressure Rating: 125 psig minimum unless otherwise indicated.
c. Material: Bronze body with corrosion-resistant interior components.
d. Temperature Control: Adjustable.
e. Connections: Threaded inlets and outlet.
f. Finish: Chrome plated.

C. Strainers

1. Y-Pattern Strainers:
   a. Pressure Rating: 125 psig minimum unless otherwise indicated.
   b. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
   c. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   d. Screen: Stainless steel with round perforations unless otherwise indicated.
   e. Perforation Size:
      1) Strainers NPS 2 and Smaller: 0.020 inch (0.51 mm).
      2) Strainers NPS 2-1/2 to NPS 4 : 0.045 inch (1.14 mm).
      3) Strainers NPS 5 and Larger: 0.10 inch (2.54 mm).
   f. Drain: Factory-installed, hose-end drain valve.

D. Hose Bibbs

1. Hose Bibbs:
   a. Standard: ASME A112.18.1 for sediment faucets.
   b. Body Material: Bronze.
   c. Seat: Bronze, replaceable.
   d. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
   e. Outlet Connection: Garden-hose thread complying with ASME B1.20.7
   f. Pressure Rating: 125 psig .
   g. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
   h. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
   i. Finish for Service Areas: Rough bronze.
   j. Operation for Equipment Rooms: Wheel handle or operating key.
   k. Operation for Service Areas: Wheel handle.
   l. Include operating key with each operating-key hose bibb.
   m. Include integral wall flange with each chrome- or nickel-plated hose bibb.

E. Drain Valves

1. Ball-Valve-Type, Hose-End Drain Valves:
   a. Standard: MSS SP-110 for standard-port, two-piece ball valves.

b. Pressure Rating: 400-psig minimum CWP.
c. Size: NPS 3/4.
d. Body: Copper alloy.
e. Ball: Chrome-plated brass.
f. Seats and Seals: Replaceable.
g. Handle: Vinyl-covered steel.
h. Inlet: Threaded or solder joint.
i. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

F. Water-Hammer Arresters

1. Water-Hammer Arresters:
   a. Standard: Certified ANSI/ASSE 1010-2004 or PDI-WH 201-2017, NSF 372.
   b. Type:
      1) Body: Seamless Type-L Copper tube with piston.
      2) Piston: Poly Piston with two EPDM O-Rings.
      3) Piston Lubrication: Dow-Corning, 111 FDA Approved Silicone Compound.
      4) Solder: Lead Free.
      5) Male MIP Thread Fitting.
   c. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201-2017, Sizes A through F.

G. Air Vents

1. Bolted-Construction Automatic Air Vents:
   a. Body: Bronze.
   b. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F .
   c. Float: Replaceable, corrosion-resistant metal.
   d. Mechanism and Seat: Stainless steel.
   e. Size: NPS 3/8 (DN 10) minimum inlet.
   f. Inlet and Vent Outlet End Connections: Threaded.
2. Welded-Construction Automatic Air Vents:
   a. Body: Stainless steel.
   b. Pressure Rating: 150-psig minimum pressure rating.
   c. Float: Replaceable, corrosion-resistant metal.
   d. Mechanism and Seat: Stainless steel.
   e. Size: NPS 3/8 minimum inlet.
   f. Inlet and Vent Outlet End Connections: Threaded.

2.03 SANITARY WASTE PIPING SPECIALTIES

A. Assembly Descriptions

1. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
2. Comply with NSF 14 for plastic sanitary waste piping specialty components.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

B. Cleanouts

1. Exposed Metal Cleanouts:
   a. Standard: ASME A112.36.2M.
   b. Size: Same as connected drainage piping
   c. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   d. Closure: Countersunk or Raised-head, brass plug.
   e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
2. Stainless-Steel Exposed Cleanouts:
   a. Standard: ASME A112.3.1 for cleanout test tee.
   b. Size: Same as connected drainage piping
   c. Body Material: Stainless-steel tee with side cleanout as required to match connected piping.
   d. Closure: Stainless-steel plug with seal.
3. Cast-Iron Exposed Floor Cleanouts:
   a. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
   b. Size: Same as connected branch.
   c. Type: Heavy-duty, adjustable housing.
   d. Body or Ferrule Material: Cast iron.
   e. Clamping Device: Required.
   f. Outlet Connection: Spigot.
   g. Closure: Brass, bronze or plastic with tapered threads.
   h. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
   i. Frame and Cover Material and Finish: Nickel-bronze, copper alloy. In finished areas provide a recessed cover for finished floor material.
   j. Frame and Cover Shape: Round.
   k. Top-Loading Classification: Extra-Heavy Duty.
   l. Riser: ASTM A74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
4. Stainless-Steel Exposed Floor Cleanouts:
   a. Standard: ASME A112.3.1.
   b. Size: Same as connected branch.
   c. Housing: Stainless steel.
   d. Closure: Stainless steel with seal.
   e. Riser: ASTM A74, Service Extra-Heavy class, stainless-steel drainage pipe fitting and riser to cleanout.
   f. Body or Ferrule Material: Stainless steel.

g. Clamping Device: Required.
h. Outlet Connection: Spigot.
i. Closure: Brass or plastic with tapered threads.
j. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
k. Frame and Cover Material and Finish: Nickel-bronze, copper alloy. In finished areas provide a recessed cover for finished floor material.
l. Top-Loading Classification: Medium Duty.

C. Floor Drain

1. Cast-Iron Floor Drains:
a. Standard: ASME A112.6.3.
b. Pattern: Area drain.
c. Body Material: Gray iron .
d. Seepage Flange: Required.
e. Anchor Flange: Not required.
f. Clamping Device: Required.
g. Outlet: Bottom.
h. Backwater Valve: Not required.
i. Coating on Interior and Exposed Exterior Surfaces: Not required.
j. Sediment Bucket: Not required.
k. Top or Strainer Material: Nickel bronze.
l. Top Shape: Round.
m. Top Loading Classification: Extra-Heavy Duty. Drains located in Corridors and other occupied spaces shall be heavy duty loading.
n. Funnel: Not required.
o. Inlet Fitting: Not required.
1) Oatey.

D. Through-Penetration Firestop Assemblies

1. Through-Penetration Firestop Assemblies:
a. Standard: ASTM E814, for through-penetration firestop assemblies.
b. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
c. Size: Same as connected soil, waste, or vent stack.
d. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
e. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
f. Special Coating: Corrosion resistant on interior of fittings.

2.04 STORM DRAINAGE PIPING SPECIALTIES

A. Cleanouts

1. Exposed Metal Cleanouts:
   a. Standard: ASME A112.36.2M.
   b. Size: Same as connected drainage piping
   c. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   d. Closure: Countersunk or Raised-head, brass plug.
   e. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
2. Cast-Iron Exposed Floor Cleanouts:
   a. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
   b. Size: Same as connected branch.
   c. Type: Heavy-duty, adjustable housing.
   d. Body or Ferrule Material: Cast iron.
   e. Clamping Device: Required.
   f. Outlet Connection: Spigot.
   g. Closure: Brass, bronze or plastic with tapered threads.
   h. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
   i. Frame and Cover Material and Finish: Nickel-bronze, copper alloy. In finished areas provide a recessed cover for finished floor material.
   j. Frame and Cover Shape: Round.
   k. Top-Loading Classification: Extra-Heavy Duty.
   l. Riser: ASTM A74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
3. Stainless-Steel Exposed Floor Cleanouts:
   a. Standard: ASME A112.3.1.
   b. Size: Same as connected branch.
   c. Housing: Stainless steel.
   d. Closure: Stainless steel with seal.
   e. Riser: ASTM A74, Service Extra-Heavy class, stainless-steel drainage pipe fitting and riser to cleanout.
   f. Body or Ferrule Material: Stainless steel.
   g. Clamping Device: Required.
   h. Outlet Connection: Spigot.
   i. Closure: Brass or plastic with tapered threads.
   j. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
   k. Frame and Cover Material and Finish: Nickel-bronze, copper alloy. In finished areas provide a recessed cover for finished floor material.
   l. Top-Loading Classification: Medium Duty.
4. Cast-Iron Wall Cleanouts:
   a. Standard: ASME A112.36.2M. Include wall access.
   b. Size: Same as connected drainage piping.
   c. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   d. Closure Plug:

1) Brass.
2) Countersunk head.
3) Drilled and threaded for cover attachment screw.
4) Size: Same as or not more than one size smaller than cleanout size.

e. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
f. Wall Access: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

PART 3 EXECUTION

3.01 INSTALLATION

A. Domestic Water Piping Specialties

1. Refer to Division 22 Section "Plumbing Piping" for piping joining materials, joint construction, and basic installation requirements.
2. Install balancing valves in locations where they can easily be adjusted.
3. Install individual fixture temperature-actuated, water mixing valves on each lavatory/sink designated for hand washing.
4. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
5. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
6. Install water-hammer arresters in water piping according to PDI-WH 201.
7. Install air vents at all high points of water piping, including at the top of any rises/falls in horizontal piping. Install drain piping and discharge onto floor drain.

B. Sanitary Waste Piping Specialties

1. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
2. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
3. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   a. Position floor drains for easy access and maintenance.
   b. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      1) Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      2) Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      3) Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
   c. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

d. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

4. Install stack air-admittance valves at top of stack vent and vent stack piping.

C. Storm Drainage Piping Specialties

1. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
   a. Use cleanouts the same size as drainage piping up to NPS 4 . Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   b. Locate cleanouts at each change in direction of piping greater than 45 degrees.
   c. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   d. Locate cleanouts at base of each vertical soil and waste stack.
2. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
3. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
4. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
5. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.
   a. Comply with requirements in Division 07 Section "Penetration Firestopping."
6. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.02 CONNECTIONS

A. Domestic Water Piping Specialties

1. Piping Connections
   a. Drawings indicate general arrangement of piping, fittings, and specialties.
   b. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

B. Sanitary Waste Piping Specialties

1. Comply with requirements in Division 22 Section 22 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.

C. Storm Drainage Piping Specialties

1. Comply with requirements for piping specified in Division 22 Section "Plumbing Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.03 FIELD QUALITY CONTROL

A. Domestic Water Piping Specialties

1. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
   a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
3. Prepare test and inspection reports.

B. Sanitary Waste Piping Specialties

1. Perform tests and inspections and prepare test reports.
   a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled and their installation, including piping and electrical connections, and to assist in testing.
2. Tests and Inspections:
   a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Storm Drainage Piping Specialties

1. Perform tests and inspections and prepare test reports.
   a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled and their installation, including piping and electrical connections, and to assist in testing.
2. Tests and Inspections:
   a. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Protection

1. Sanitary Waste Piping Specialties
   a. Place plugs in ends of uncompleted piping at end of each day or when work stops.
   b. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
2. Storm Drainage Piping Specialties
   a. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.04 ADJUSTING

A. Domestic Water Piping Specialties

1. Set field-adjustable flow set points of balancing valves.
2. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221006

SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall-Mounted Water Closets.

B. Water Closet Flushometer Valves.

C. Toilet Seats.

D. Wall-Hung Urinals.

E. Urinal Flushometer Valves.

F. Vitreous-China, Wall-Mounted Lavatories.

G. Solid-Brass, Automatically Operated Lavatory Faucets.

H. Counter Sinks.

I. Sink Faucets.

J. Supply Fittings.

K. Waste Fittings.

L. Supports.

M. Grout.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000 , apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Division 22 Section 224500 "Emergency Plumbing Fixtures" for emergency fixtures.

1.04 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

1.05 SUBMITTALS

A. Action Submittals

1. Product Data: For each type of product.
   a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
   b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Product Data: For water consumption.
3. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

B. LEED Submittals

1. Plumbing Fixtures: Provide the following:
   a. Manufacturer cut sheet indicating water consumption.
   b. WaterSense certification for residential fixtures, commercial water closets, commercial urinals, and commercial showers.

C. Operation and Maintenance Materials

1. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.
2. Operation and Maintenance Data: For flushometer valves, lavatories and faucets and electronic sensors to include in operation and maintenance manuals.
   a. In addition to items specified in Division 01 Section 01 78 23 "Operation and Maintenance Data," include the following:
      1) Servicing and adjustments of automatic faucets and flush valves.

1.06 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 PRODUCTS

2.01 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, accessible.

1. Manufacturers:
   a. American Standard America.
   b. Kohler Co.
   c. Sloan Valve Company.
2. Bowl:
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.1 gal per flush.
   h. Spud Size and Location: NPS 1-1/2 ; top.
   i. Color: White.
3. Flushometer Valve: .
4. Toilet Seat: .
5. Support: Water closet carrier .
6. Water-Closet Mounting Height: Standard height or Handicapped/elderly, complying with ANSI/ ICC A117.1 Refer to architectural plans.

2.02 WATER CLOSET FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Manufacturers:
   a. American Standard
   b. Sloan Valve Company.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig .
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.1 gal per flush.
12. Minimum Inlet: NPS 1 .

13. Minimum Outlet: NPS 1-1/4 .

2.03 TOILET SEATS

A. Toilet Seats:

1. Manufacturers:
   a. American Standard America.
   b. Bemis Manufacturing Company.
   c. Church Seats.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.04 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, washout, accessible.

1. Manufacturers:
   a. Kohler Co.
   b. Sloan Valve Company.
   c. TOTO USA, INC.
2. Fixture:
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5 .
   b. Material: Vitreous china.
   c. Type: Washout with extended shields.
   d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
   e. Water Consumption: Water saving.
   f. Spud Size and Location: NPS 3/4 , back.
   g. Outlet Size and Location: NPS 2 , back.
   h. Color: White.
3. Flushometer Valve: .
4. Waste Fitting:
   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 2 .
5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

6. Urinal Mounting Height: Standard height or Handicapped/elderly, complying with ANSI/ ICC A117.1.

2.05 URINAL FLUSOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves :

1. Manufacturers:
   a. Kohler Co.
   b. Sloan Valve Company.
   c. TOTO USA, INC.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951 listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: .0125 gal per flush.
12. Minimum Inlet:NPS 3/4 (DN 20).
13. Minimum Outlet: NPS 3/4 (DN 20).
    a. Kohler Co.

2.06 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Ledge back, vitreous china, wall mounted.

1. Manufacturers:
   a. Kohler Co.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Fixture:
   a. Standard: ASME A112.19.2/CSA B45.1.
   b. Type: For wall hanging.
   c. Nominal Size: Oval,18 by 20 inches
   d. Faucet-Hole Punching: One hole.
   e. Faucet-Hole Location: Top.
   f. Color: White.
   g. Mounting Material: Chair carrier.

3. Support: ASME A112.6.1M,Type I, exposed-arm lavatory carrier
4. Lavatory Mounting Height: Standard height or Handicapped/elderly, complying with ANSI/ ICC A117.1.

2.07 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Automatic-type,battery-powered,electronic-sensor-operated, mixing, solid-brass valve.

1. Manufacturers:
   a. Chicago Faucets.
   b. Sloan Valve Company.
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. 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.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck, concealed .
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Not part of faucet .

2.08 COUNTER SINKS

A. Sinks: Stainless steel, lay-in counter mounted.

1. Manufacturers:
   a. Elkay Manufacturing Co.
   b. Just Manufacturing.
2. Fixture:
   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Type: Lay-in.
   c. Number of Compartments: One.
   d. Metal Thickness: 0.050 inch.
   e. Compartment:
      1) Drain: Grid with NPS 1-1/2 (DN 40).
      2) Drain Location: Centered in compartment.

3. Faucet(s): .
   a. Number Required: One.
   b. Mounting: Deck.
4. Supply Fittings:
   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
      1) Operation: Loose key.
      2) Risers: NPS 1/2 .
5. Waste Fittings:
   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s):
      1) Size: NPS 1-1/2 (DN 40).
      2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall and chrome-plated brass or steel wall flange.
      3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012 inch thick stainless-steel tube to wall; and stainless-steel wall flange.
6. Mounting: On counter with sealant.

2.09 SINK FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, single-control mixing valve.

1. General-Duty, Solid-Brass Faucets.
   a. Manufacturers:
      1) Chicago Faucets.
      2) Delta Faucet Company.
      3) Kohler Co.
      4) Moen Incorporated.
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Chrome plated.
7. Maximum Flow Rate: 2.2 gpm (8.3 L/min.) .
8. Handle(s): Lever.
9. Mounting Type: Deck, concealed.
10. Spout Type: Rigid, solid brass.
11. Vacuum Breaker: Required for hose outlet.

12. Spout Outlet: Aerator.

2.10 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. Refer to fixture schedule for sizes.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.11 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Lavatory:

1. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
2. Trap:
   a. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32) unless otherwise scheduled.
   b. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-(0.83-mm-) thick brass tube to wall; and chrome-plated, brass or steel wall flange.
   c. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012 inch thick stainless-steel tube to wall; and stainless-steel wall flange.

C. Sink:

1. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
2. Trap:
   a. Size: NPS 1-1/2 unless otherwise scheduled.
   b. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-(0.83-mm-) thick brass tube to wall; and chrome-plated brass or steel wall flange.
   c. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.
      1) Florestone Products Co., Inc.

2.12 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers:
   a. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

B. Type I Urinal Carrier:

1. Manufacturers:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Wade Drains.
   e. Watts; a Watts Water Technologies company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

C. Type II Lavatory Carrier:

1. Manufacturers:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Wade Drains.
   e. Watts; a Watts Water Technologies company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

2.13 GROUT

A. Refer to Division 20 Section 200500 “Common Work Results” for requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine counters, walls, and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ANSI/ICC A117.1.
3. Support Installation:
   a. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
   b. Use carrier supports with waste-fitting assembly and seal.
   c. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
4. Flushometer-Valve Installation:
   a. Install flushometer-valve, water-supply fitting on each supply to each water closet.
   b. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
   c. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
5. Install toilet seats on water closets.
6. Wall Flange and Escutcheon Installation:
   a. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
   b. Install deep-pattern escutcheons if required to conceal protruding fittings.
   c. Comply with escutcheon requirements specified in Division 20 Section 200500 "Common Work Results."
7. Joint Sealing:
   a. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
   b. Match sealant color to water-closet color.
   c. Comply with sealant requirements specified in Division 07 Section 07 92 00 "Joint Sealants."

B. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ANSI/ICC A117.1.
4. Support Installation:
   a. Install supports, affixed to building substrate, for wall-hung urinals.
   b. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
   c. Use carriers without waste fitting for urinals with tubular waste piping.
   d. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

5. Flushometer-Valve Installation:
    a. Install flushometer-valve water-supply fitting on each supply to each urinal.
    b. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
    c. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
6. Wall Flange and Escutcheon Installation:
    a. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
    b. Install deep-pattern escutcheons if required to conceal protruding fittings.
    c. Comply with escutcheon requirements specified in Division 20 Section 200500 "Common Work Results."
7. Joint Sealing:
    a. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
    b. Match sealant color to urinal color.
    c. Comply with sealant requirements specified in Division 07 Section 07 92 00 "Joint Sealants."

C. Lavatory Installation:

1. Install lavatories level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ANSI/ICC A117.1.
4. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 20 Section 200500 "Common Work Results."
5. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section 07 92 00 "Joint Sealants."
6. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Division 20 Section 200700 "Mechanical Insulation."

D. Sink Installation:

1. Install sinks level and plumb according to roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-hung sinks.
3. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ANSI/ICC A117.1.
4. Install water-supply piping with stop on each supply to each sink faucet.
    a. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 20 Section 20 05 23 "General-Duty Valves for Piping."
    b. Install stops in locations where they can be easily reached for operation.

5. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 20 Section 200500 "Common Work Results."
6. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section 07 92 00 "Joint Sealants."
7. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 20 Section 200700 "Mechanical Insulation."

3.03 CONNECTIONS

A. Piping Connections

1. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
2. Where installing piping adjacent to fixtures, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, flushometer valves, shower heads, etc. to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING

A. After completing installation of fixtures, inspect and repair damaged finishes.

B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Emergency Showers.

B. Eyewash Equipment.

C. Water-Tempering Equipment.

D. Source Quality Control.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 SUBMITTALS

A. Action Submittals

1. Product Data: Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.
2. Field Test Reports: Plumbing fixture operational tests.

B. Informational Submittals

C. Closeout Submittals

D. Operation and Maintenance Materials

E. Record Documents

PART 2 PRODUCTS

2.01 EMERGENCY SHOWERS

A. Off-Floor, Plumbed Emergency Showers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Safety; a division of Acorn Engineering Company.
   b. Guardian Equipment Co.
   c. WaterSaver Faucet Co.
2. Capacity: Not less than 20 gpm for at least 15 minutes.
3. Supply Piping: NPS 1 (DN 25) galvanized steel.
4. Control-Valve Actuator: Pull rod.
5. Shower Head: 10-inch minimum diameter, stainless steel.
6. Mounting: Vertical from ceiling and supported from piping.

2.02 EYEWASH EQUIPMENT

A. Sink, Swivel-Type, Plumbed Eyewash Unit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Safety; a division of Acorn Engineering Company.
   b. Guardian Equipment Co.
   c. WaterSaver Faucet Co.
2. Capacity: Not less than 0.4 gpm for at least 15 minutes.
3. Supply Piping: NPS 1/2 (DN 15) chrome-platd brass or stainless steel with flow regulator and stay-open control valve.
4. Control-Valve Actuator: Movement of spray-head assembly to position over sink.
5. Spray-Head Assembly: Two spray heads with offset piping.
6. Mounting: Deck next to sink.

2.03 WATER-TEMPERING EQUIPMENT

A. Hot- and Cold-Water, Water-Tempering Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Bradley Corporation.
   c. Guardian Equipment Co.
   d. Watts; a Watts Water Technologies company.
2. Description: Factory-fabricated equipment with thermostatic mixing valve.
   a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure. Mixing valve shall have 10 psi maximum pressure loss for required emergency equipment flowrate.
   b. Supply Connections: For hot and cold water.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 22 05 23 "Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Division 22 Section 22 11 16 "Domestic Water Piping."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Division 22 Section 22 05 19 "Meters and Gages for Plumbing Piping."

G. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Division 20 Section 20 05 18 "Common Work Results for Mechanical."

3.03 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Division 22 Section 22 11 16 "Domestic Water Piping."

B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 22 22 11 16 "Domestic Water Piping."

C. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.04 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.05 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Division 20 Section 20 05 53 "Identification for Piping and Equipment."

3.06 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 226113 - COMPRESSED-AIR PIPING FOR LABORATORY AND HEALTHCARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipes, Tubes, and Fittings.

B. Joining Materials.

C. Valves.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 11 11 53 13 "Laboratory Fume Hoods" for compressed-air outlets in laboratory fume hoods.

B. Section 12 12 35 53 "Laboratory Casework" for compressed-air outlets in laboratory casework.

1.04 DEFINITIONS

A. Nonmedical compressed-air piping systems include laboratory air piping systems.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Qualification Data: For Installer and testing agency.

C. Material Certificates: Signed by Installer certifying that medical compressed-air piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

D. Brazing certificates.

E. Field quality-control reports.

F. Operation and Maintenance Data: For compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE 6020 for medical-gas-system inspectors and ASSE 6030 for medical-gas-system verifiers.

B. Brazing: Qualify processes and operators according to ASME BPVC-IX, "Welding and Brazing Qualifications"; or AWS B2.2/B2.2M, "Standard for Brazing Procedure and Performance Qualification."

1.07 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.08 SUMMARY DESCRIPTION

A. Section Includes:

1. Compressed-air piping and specialties for nonmedical laboratory facilities, designated "laboratory air."

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Laboratory air operating at 50 psig (345 kPa).

2.02 PIPES, TUBES, AND FITTINGS

A. Comply with NFPA 99 for medical air piping materials.

B. Copper Medical Gas Tube: ASTM B819, Type L, seamless, drawn temper, that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and in blue for Type L tube.

C. Wrought-Copper Fittings: {RS#367}, solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

D. Copper Unions: {RS#367} or MSS SP-123, wrought-copper or cast-copper alloy.

E. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos free, 1/8 inch maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1 , carbon steel.

2.03 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys.

B. Threaded-Joint Tape: PTFE.

2.04 VALVES

A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amico Corporation.
   b. BeaconMedaes.
   c. NIBCO INC.
2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig (2070 kPa) minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.
8. Stem: Blowout proof with PTFE or TFE seal.
9. Ends: Manufacturer-installed ASTM B819 , copper-tube extensions.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. BeaconMedaes.
2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig (2070 kPa) minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B819, copper-tube extensions.

D. Safety Valves:

1. Bronze body.
2. ASME-construction, poppet, pressure-relief type.
3. Settings to match system requirements.

E. Pressure Regulators:

1. Bronze body and trim.
2. Spring-loaded, diaphragm-operated, relieving type.
3. Manual pressure-setting adjustment.
4. Rated for 250-psig (1725-kPa) minimum inlet pressure.
5. Capable of controlling delivered air pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Comply with NFPA 99 for installation of compressed-air piping.

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

H. Install eccentric reducers, if available, where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

I. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

J. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."

K. Install piping to permit valve servicing.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and for branch connections.

N. Piping Restraint Installation: Install seismic restraints on compressed-air piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

O. Install compressed-air service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.

P. Connect compressed-air piping to air compressors and to compressed-air outlets and equipment requiring compressed-air service.

Q. Install unions in copper compressed-air tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.02 VALVE INSTALLATION

A. Install shutoff valve at each connection to and from compressed-air equipment and specialties.

B. Install check valves to maintain correct direction of compressed-air flow from compressed-air equipment.

C. Install pressure regulators on compressed-air piping where reduced pressure is required.

3.03 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

B. Threaded Joints: Apply appropriate tape to external pipe threads.

C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free dry nitrogen during brazing.

D. Flanged Joints: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

E. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 20 20 05 48 "Vibration and Seismic Controls for Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Section 20 20 05 29 "Hangers and Supports for Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or Type 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches 12 inches (300 mm) of each fitting and coupling.

H. Rod diameter may be reduced one size for double-rod hangers, with 3/8 inch minimum rods.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 (DN 8): 60 inches with 3/8 inch rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches with 3/8 inch rod.
3. NPS 3/4 (DN 20): 84 inches with 3/8 inch rod.
4. NPS 1 (DN 25): 96 inches with 3/8 inch rod.
5. NPS 1-1/4 (DN 32): 108 inches with 3/8 inch rod.
6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8 inch rod.
7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8 inch rod.

J. Install supports for vertical copper tubing every 10 feet (3 m).

3.05 IDENTIFICATION

A. Install identifying labels and devices for nonmedical laboratory compressed-air piping, valves, and specialties. Comply with requirements in Section 20 20 05 53 "Identification for Piping and Equipment."

B. Install identifying labels and devices for medical compressed-air piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

3.06 FIELD QUALITY CONTROL FOR COMPRESSED-AIR PIPING IN NONMEDICAL LABORATORY FACILITIES

A. Testing Agency: Owner will engage qualified testing agency to perform tests and inspections of compressed-air piping in nonmedical laboratory facilities and to prepare test and inspection reports.

B. Tests and Inspections:

1. Piping Leak Tests for Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill compressed-air piping with oil-free dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa) . Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters for proper operation.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.07 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.08 PIPING SCHEDULE

A. Flanges may be used where connection to flanged equipment is required.

B. Laboratory Air Piping except Laboratory Air Piping Larger Than NPS 3 (DN 80) and Operating at More Than 185 psig (1275 kPa): Type L, copper medical gas tube; wrought-copper fittings; and brazed joints.

3.09 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 226113

SECTION 226200 - LABORATORY VACUUM PLUMBING SYSTEMS

1.1 SECTION INCLUDES

1.01 REFERENCE STANDARDS

A. ANSI - Power Operated Pedestrian Doors; 2005.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

C. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015, with Amendment (2024).

D. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2019.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.02 A. LOCAL VACUUM NETWORK SYSTEM, INCLUDING THE FOLLOWING COMPONENTS:

A. Pumps

B. Controls

C. Valves

D. Interconnecting tubing

E. Inlets

F. Valves

G. Identification

H. Supports

I. Accessories

1.2 RELATED SECTIONS

1. Section 11600 – Laboratory Equipment
2. Section 11610 – Laboratory Fume Hoods
3. Section 12360 – Laboratory Casework

1.3 REFERENCES

1. American National Standards Institute (ANSI): ANSI/ASQ/ISO Q9001 – Quality Management Systems Requirements Standard

2. International Standards Organization (ISO): ISO 14001 – Environmental Management Systems – Requirements with guidance for use.
3. International Electrotechnical Commission (IEC): IEC 60529 - Degrees of protection provided by enclosures (IP Code).
4. National Electrical Manufacturers Association (NEMA).
5. National Fire Protection Association (NFPA):
   a. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals.
   b. NFPA 70 - National Electric Code.

1.4 SUBMITTALS

1) Submit under provisions of Section 01300.
2) Product Data: Manufacturer's data sheets on each product to be used, including:
   (a) Manufacturer's descriptive literature, illustrations and installation instructions for all components included within this project.
   (b) Preparation instructions and recommendations.
   (c) Storage and handling requirements and recommendations.
   (d) Installation methods.
3) Shop Drawings: Provide dimensional drawings indicating details of construction and installation. Include templates for coordination with adjacent work.
4) Operations and Maintenance Data: Servicing and testing requirements, inspection data, installation instructions, replacement part numbers and availability, location and contact numbers of service depot.
5) Record Documents:
   (a) Installation Contractor for local vacuum networks shall record actual locations of pumps, valves, and distribution and exhaust piping.
   (b) Record of test procedures and the results of all tests indicating room and area designations, dates of the tests, and names of persons conducting tests.
   (c) Documentation and description of manufacturer's warranties.

1.5 QUALITY ASSURANCE

1) Compliance: Materials, equipment, installation, testing and certification shall be in strict accordance with NFPA 45.
2) System Verification Testing for Local Vacuum Networks: Testing shall be conducted by installer under the guidance of manufacturer, and with oversight by the Owner or Owner's agent.
3) Qualifications:
   (a) General: Company specializing in manufacture, installation, testing, certifying and servicing the products and systems specified with a minimum of 5 years documented experience.
   (b) Manufacturers: Firms regularly engaged in manufacture of vacuum systems equipment and products, of types, material and sizes similar to systems and products specified herein, whose products have been in satisfactory use in similar service for not less than 5 years. Submit references if requested.

(c) Equipment Suppliers: The vacuum systems equipment supplier shall provide the services of a manufacturer authorized product specialist to periodically coordinate with the installing Contractor during initial installation of piping and vacuum systems.

(d) Service Organizations:

(1) Service by in-house facility personnel.

(2) Service performed by manufacturer-authorized repair facility to which components of system will be shipped.

(e) Installers: Minimum of 2 years' experience with successful installation experience on project with vacuum systems.

4) Single Source Requirements: Pumps, valves, inlets, alarms, controls, tubing and associated components shall be supplied by a single manufacturer to the greatest extent possible and shall be fully compatible with one another.

5) Identification:

(a) Valves: Manufacturer's name shall be marked on valve bodies.

(b) Equipment: Manufacturer's name, address, and contact information shall be permanently marked on equipment.

6) Tubing Connections: Consist of vacuum compression fittings. Connections tested with a vacuum gauge of sufficient resolution to determine that the completed network conforms to manufacturer's specifications for effective vacuum pressures.

1.6 DELIVERY, STORAGE, AND HANDLING

1) Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Protect from damage, theft, vandalism, exposure to precipitation, freezing temperatures, and direct sunlight.

2) Store products in manufacturer's unopened, labeled packaging, until ready for installation.

3) Each length of tube shall be delivered packaged by manufacturer and kept sealed until being prepared for installation.

4) Loose fittings, valves, gauges and other components shall be delivered sealed and labeled and kept sealed until installation.

5) Where contamination has occurred, materials must be removed and replaced with materials that have been cleaned and sealed by the manufacturer or supplier.

6) Provide equipment and personnel necessary to handle equipment and components with methods approved by manufacturer to prevent damage to products or packaging. Provide additional protection so as to protect products or surrounding areas from damage.

7) Life components only at designated lifting points and in accordance with operating manual lifting procedures.

1.7 SEQUENCING AND SCHEDULING

1) Schedule work to ensure installation is completely tested and certified prior to substantial completion.

2) Sequence installation of PTFE plastic vacuum tubing so that it will not be subjected to damage from the heat of brazing, soldering, or welding adjacent piping.
3) Pre-drill at casework manufacturer's factory all lab bench tops with penetrations needed for on-site mounting of vacuum valves.
4) Pre-drill at fume hood manufacturer's factory penetrations needed for on-site mounting of vacuum valves, fittings, and controls. Pre-install vacuum valves, fittings, and controls as specified in contract documents.
5) Pre-drill at biosafety cabinet manufacturer's factory penetrations needed for on-site mounting of vacuum valves, fittings, and controls. Pre-install vacuum valves, fittings, and controls as specified in contract documents.

1.8 WARRANTY

1) Manufacturer's Standard Warranty:
   (a) Warranty Period for Defects in Materials and Workmanship: 1 year from date of system start-up, under normal use.
   (b) Warranty Period for Vacuum Network Equipment: 1 year.

PART 2: PRODUCTS

9.01 2.1 MANUFACTURERS

1) Acceptable Manufacturer BRANDTECH SCIENTIFIC, INC, which is located at 11 Bokum Road, Essex, CT 06426. Telephone 1-888-522-2726. Email: orders@brandtech.com.

9.02 WEB: WWW.VACUU-LAN.COM.

1) Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 LOCAL VACUUM NETWORK SYSTEMS

1) Local Vacuum Network System: VACUU·LAN® system components as manufactured by VACUUBRAND GMBH + CO KG of Germany and supplied by BrandTech Scientific, Inc. of the USA.
   (a) General: Materials shall meet or exceed applicable reference standards, federal, state, and local requirements; and conform to codes and ordinances of authorities having jurisdiction.
      (1) VACUU·LAN® components are not approved for operation in potentially explosive atmospheres.
      (2) Local vacuum networks that serve more than one laboratory shall be equipped with demand-responsive electronic controls which enable the server pumping unit to provide vacuum when needed, while moving to standby mode in the absence of immediate vacuum demand.
      (3) Local vacuum networks restricted to a single laboratory may be equipped with demand-responsive electronic control, or may be actuated manually. Manual actuation may be achieved by the switch on the pump or by a wall-switch-actuated electrical outlet.

(b) System: Local vacuum networks shall consist of oil-free diaphragm vacuum pumps with corrosion-resistant wetted materials made of fluoropolymers such as PTFE and fluoroelastomers such as FFKM, vacuum valves with fluoroelastomer check valves, PTFE vacuum tubing, and chemical-resistant connectors and fittings.

(c) Venting: Route exhaust from local vacuum networks via PTFE tubing into lab exhaust, such as through direct connection, by venting through fume hoods, or by another manufacturer-approved method.

(d) Technical Data:

(1) Leak Rate: 1 x 10-2 mbar-L/s per component.
(2) Maximum Gas Temperature (exposure < 5 minutes): 176°F (80°C)
(3) Maximum Gas Temperature (continuous exposure): 140°F (60°C)
(4) Maximum Ambient Temperature: 104°F (40°C)

(e) Electronic Controls: Demand-responsive operation of pumps for VACUU·LAN® local vacuum networks.

(1) Controllers: VACUU·SELECT® controller
(2) Vacuum controller shall be included as part of pumping unit.
(3) Vacuum controller shall have means to record and display operating hours, and to alert users when preventative maintenance is required.
(4) Accessory Components controlled by Controller: VACUU·BUS® accessory components
(5) Liquid Level sensor
(6) Solenoid operated vacuum valve

2) Local Vacuum Network Pumps: VACUU·LAN® local vacuum network pumps, manufactured by VACUUBRAND GMBH + CO KG of Germany and supplied by BrandTech Scientific, Inc. of the USA.

2. Design: Oil-free, dry-running pumps featuring corrosion resistant diaphragms, heads, and valves; with corrosion-resistant wetted materials made of fluoropolymers such as PTFE and fluoroelastomers such as FFKM; 120 V, 60 Hz power required via conventional NEMA 15-5 grounded outlet. Rotary vane, scroll, liquid ring, dry vane, and other vacuum pump designs are not acceptable.

3. Description: Including inlet and outlet catchpots (glass collection flasks) to collect condensed gases and vapors.

(1) Each vacuum pump shall have an end (ultimate) vacuum equal to or better than
(2) 53 torr 27.8 inch. Hg)
(3) Each pump shall operate oil-free and shall require service at typical intervals no more frequently than 15,000 operating hours, when installed and operated per manufacturer's instructions. Each pump shall be capable of operating continuously at its rated end (ultimate) vacuum level on a continuous basis without deleterious impact on the typical service intervals or pump life.
(4) Each pump shall include inlet and outlet catchpots (glass collection flasks) with a minimum capacity (volume) of 500 mL to collect condensed gases and vapors.
(5) Each pump shall have fluoropolymer (e.g., PTFE, ETFE, ECTFE, and PVDF) and perfluoroelastomer (e.g., FFKM) wetted materials to protect against corrosion by common laboratory chemicals.

(6) Pumps shall have a typical noise rating based on EN ISO 5151:2018 and EN ISO 3744:1995. Pumps designed to fit into a pump cabinet 24 inches wide or smaller shall have a noise rating of 47 dB(A) or less. Pumps designed to fit into a cabinet wider than 24 inches shall have a noise rating 54 dB(A) or less.

(7) Pumps shall have a maximum weight of 70 pounds (31.8 kg).

(b) Electronically Controlled Units: Electronically controlled vacuum pumps may be equipped with liquid level sensors on the inlet or outlet catchpots.

(1) Install liquid level sensors on outlet catchpots.

(c) Pump Ventilation: Vacuum pumps shall be air cooled and have no water requirements, unless water-cooled condensers are specified for emissions capture.

(1) Ventilation method: active ventilation through fan-assisted ventilation lines with extraction at back of cabinet and cabinet door louvered at bottom, as provided by others.

(d) Electronically Controlled Pump Models

(1) Pumping Units/Systems: PC 3016 NT VARIO select Chemistry Pumping Units.

2) Local Vacuum Network Tubing: Interconnecting PTFE tubing and compatible joints and fittings as provided by BrandTech Scientific, Inc.

(a) Size: 0.39 inch OD / 0.31 inch ID.

(b) Composition: PTFE (polytetrafluoroethylene), such as Teflon or manufacturer approved equal.

(c) Straight Unions, T-Unions, Elbow Unions, Offsets and Fittings: Chemical resistant PVDF plastic.

(d) Minimum Turn Radius without Compression Fittings: 8 inches.

(e) Corrosion Resistant PVDF Plastic Compression Fittings: In locations where turning radius for PTFE tubing is less than 8 inches.

(f) Installation: Exhaust tubing shall be free of dips and loops that could trap condensate.

3) Local Vacuum Network Fixtures: Fixtures (inlets) as manufactured by VACUUBRAND GMBH + CO KG of Germany and supplied by BrandTech Scientific, Inc. of the USA.

(a) General: Compatible with other components of VACUU-LAN local vacuum network. Modular design. Inlets flush-mounted on lab benches for attachment to concealed piping or surface mounted with exposed tubing. Factory assembled, tested, cleaned and supplied with protective packaging.

(1) Valve inlets: Consist of barbed tubing fitting designed to be compatible with flexible vacuum tubing.

(2) Each fixture connected to the vacuum system shall have an integral perfluoroelastomer (FFKM) check valve to ensure stability of line pressure and to mitigate risk of cross-contamination.

(b) Bench/Wall Valve Modules

(1) Bench/Wall Modules: VACUU-LAN VCL 02 Shut-off/Manual Flow Control Modules.

(2) Mounting Bases: A5, Flush mount, concealed tubing.

(3) Bench/Wall Modules: VACUU-LAN VCL K Manual Shut-off Modules.

(4) Mounting Bases: A5, Flush mount, concealed tubing.

(c) Modules in Fume Hoods:
(1) VACUU-LAN VCL AR Manual Flow Control Modules (2 piece design)
(2) Mounting Bases: Flush mount, concealed tubing.

4) Equipment Schedule:
(a) Refer to project drawings.

PART 3: EXECUTION

3.1 PREPARATION

1) If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
2) Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
3) Commencement of installation constitutes acceptance of conditions.

3.2 INSTALLATION

1) Install in accordance with manufacturer's written instructions and recommendations. Prevent oil or grease from being introduced into tubing. Do not install components that have become contaminated internally.
2) Vacuum network tubing shall be of PTFE of appropriate diameter and finish, as supplied by the vacuum network vendor. Tubing connections shall consist of compression fittings, with connections tested with a vacuum gauge of sufficient resolution to determine that the completed network conforms to manufacturer's specifications for effective vacuum pressures.
3) Locate and sequence installation of PTFE plastic vacuum tubing so that it will not be subjected to damage from the heat of brazing, soldering or welding adjacent tubing.
4) Locate equipment with adequate space for service, air circulation, tubing bends and access to condensate catchpots for routine operation. Provide no less than minimum as recommended by manufacturer.
5) Pumps may be contained within cabinets but only with manufacturer-approved provisions made for adequate air circulation to ensure that ambient operating temperatures do not exceed 104 degrees Fahrenheit. Periodically confirm that operating temperatures are within manufacturer recommended limits in the course of network operation to avoid invalidation of warranty.
6) Pre-drill casework at casework manufacturer's factory to the greatest extent possible. Bench penetrations shall be in accordance with system design, and shall conform to component manufacturer's drilling templates.
7) Pre-punch/drill fume hood and biosafety cabinet penetrations at fume hood manufacturer's factory to the greatest extent possible. Penetrations shall be in accordance with system design, and shall conform to component manufacturer's drilling templates.
8) Tubing shall be free of dips and loops that could trap condensate.

9) Vacuum exhaust from multiple pumps shall be connected individually to the lab exhaust system to minimize backpressure on the pumps.
10) Minimum Turn Radius for PTFE Tubing:
    (a) Without Compression Fittings: 8 inches.
    (b) For turns with radius of less than 8 inches: Accomplish with corrosion resistant PVDF plastic compression fittings, elbow (' L') connectors to prevent kinks or blockages.

3.3 TESTING AND INSPECTION

1) Inspection and testing shall be performed on all new vacuum systems, additions, renovations, temporary installations, or repaired systems. Assure facility, by means of documented procedure, that system integrity has been achieved or maintained.
2) Inspection and testing of local vacuum network pumps shall be performed at the factory. Following installation of local vacuum network pumps, tubing, connectors and valves, the entire network shall be tested to confirm that design vacuum pressures are obtained, that the system is functioning properly and that system integrity has been achieved or maintained. Such test shall be conducted by turning on network server pump, and testing vacuum at the pump and at the most distant valve from the pump on the vacuum network with a gauge of 1 mbar resolution to confirm vacuum pressure at pump and throughout network are consistent with design specification.
3) Installer shall perform initial vacuum tests before third party system verification.
4) Do not use water or air pressure to test system integrity. Vacuum system must be tested under vacuum according to manufacturer recommended procedure using digital vacuum gauge with resolution of 1 mbar or better and with vacuum pump having an ultimate vacuum appropriate for the system vacuum level indicated in 2.2.B.2 above.
5) System verification tests shall be performed after installer-performed tests have been completed. Equipment vendor or installing Contractor may not perform system verification, final testing or certification, except as directed by Architect or Owner.
6) System verification tests shall confirm that vacuum network pumps contained within cabinets have sufficient air circulation to ensure that ambient air temperatures do not exceed 104°F (40°C).
7) Certifications shall clearly state that the system is approved for laboratory use. Any exceptions or limitations shall be clearly stated on the same certification documentation.

3.4 FIELD QUALITY CONTROL

1) An authorized vendor of the equipment manufacturer shall periodically check with the installing Contractor during initial installation of VACUU-LAN local vacuum networks and shall assist the Contractor in final checking. Equipment manufacture to provide instruction of mutually agreeable duration and detail, not to exceed 4 hours, to Owner's personnel in the use of the vacuum system. Training may be conducted remotely, or on-site, at the owner’s option. Installation contractor shall schedule training with manufacturer’s representative in at least 4 weeks in advance of training date, providing reasonable notice to manufacturer’s representative of any changes.

2) Following installation of local vacuum network pumps, tubing, connectors and valves, the entire network shall be tested to confirm that design vacuum pressures are obtained, that the system is functioning properly and that system integrity has been achieved or maintained. Such test shall be conducted by turning on network server pump, and testing vacuum at the pump and at the most distant valve from the pump on the vacuum network with a gauge of 1 mbar resolution to confirm vacuum pressure at pump and throughout network are consistent with design specification.

3.5 CLEANING, MAINTENANCE, AND PROTECTION

1) Remove dirt, dust, construction debris and all foreign materials from installed equipment and components. Finishes shall be free from all rust, scratches, dents or other damage.
2) Protection: Protect installed work from damage due to subsequent construction activity on the site.

END OF SECTION 226200

SECTION 226313 - GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipes, Tubes, And Fittings.

B. Joining Materials.

C. Valves.

D. Ceiling Columns.

E. Simplex Specialty Gas Manifolds.

F. Duplex Specialty Gas Manifolds.

G. Gas Cylinder Storage Racks.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Division 11 Section 11 53 13 "Laboratory Fume Hoods" for gas outlets in laboratory fume hoods.

B. Division 12 Section 12 35 53 "Laboratory Casework" for gas outlets in casework.

1.04 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

C. Qualification Data: For Installer.

D. Material Certificates: Signed by Installer certifying that medical gas piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.

E. Brazing certificates.

F. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by {RS#396}.

G. Field quality-control reports.

H. Operation and Maintenance Data: For medical gas piping specialties to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Brazing: Qualify processes and operators according to ASME BPVC-IX, "Welding and Brazing Qualifications"; or AWS B2.2/B2.2M, "Standard for Brazing Procedure and Performance Qualification."

PART 2 PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Copper Medical Gas Tube: ASTM B819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service; or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.

B. Wrought-Copper Fittings: {RS#367} , solder-joint pressure type that has been manufacturer cleaned, purged, and bagged for oxygen service according to CGA G-4.1.

C. Copper Unions: {RS#367} or MSS SP-123, wrought-copper or cast-copper alloy.

D. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.

1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8 inch maximum thickness, full-face type.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.

2.02 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys.

2.03 VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. Apollo Flow Controls; Conbraco Industries, Inc.
   d. BeaconMedaes.
   e. Marwin Valve; a division of Richards Industries.
   f. NIBCO INC.
   g. Ohio Medical Corporation.
   h. Tri-Tech Medical Inc.
2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig (2070 kPa) minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.
8. Stem: Blowout proof with PTFE or TFE seal.
9. Ends: Manufacturer-installed ASTM B819 , copper tube extensions.
10. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
    a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Healthcare Products Inc.; Chemetron Division.
   b. Amico Corporation.
   c. Apollo Flow Controls; Conbraco Industries, Inc.
   d. BeaconMedaes.
   e. Ohio Medical Corporation.
   f. Tri-Tech Medical Inc.
2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig (2070 kPa) minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B819, copper-tube extensions.
6. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
   a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

C. Pressure Regulators:

1. Bronze body and trim.
2. Spring-loaded, diaphragm-operated, relieving type.
3. Manual pressure-setting adjustment.
4. Rated for 250-psig (1725-kPa) minimum inlet pressure.
5. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig (5.0 kPa for each 100-kPa) inlet pressure.
6. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
   a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

2.04 DUPLEX SPECIALTY GAS MANIFOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airgas, Inc.
2. Air Liquide America Specialty Gases LLC.
3. Air Products and Chemicals, Inc.
4. BeaconMedaes.
5. Praxair Technology, Inc.

B. Manufacturer cleaned, purged, and sealed, for all medical gas type, for oxygen service in accordance with CGA G-4.1.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 , by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Central Control-Panel Unit: Weatherproof cabinet, supply and delivery pressure gages, electrical alarm-system connections and transformer, indicator lights or devices, manifold connection, line-pressure regulator, shutoff valves, and safety valve.

E. Manifold and Headers: Duplex, nonferrous-metal header for number of cylinders indicated, divided into two equal banks. Units include design for 2000-psig (13.8-MPa) minimum inlet pressure, cylinder-bank headers with inlet (pigtail) connections complying with CGA V-1, individual inlet check valves, shutoff valve, pressure regulator, check valve, and pressure gage.

F. Operation: Automatic, pressure-switch-activated changeover from one cylinder bank to the other when first bank becomes exhausted, without line-pressure fluctuation or resetting of regulators and without supply interruption by shutoff of either cylinder-bank header.

G. Mounting: Wall with mounting brackets for manifold control cabinet and headers.

H. Label manifold control unit with permanent label identifying specialty gas type and system operating pressure.

I. Manifold: For two cylinders and 55-psig (380-kPa) line pressure, with electric heater or orifice design that will prevent freezing during high demand.

J. Specialty Gas Cylinders: Furnished by Owner.

2.05 GAS CYLINDER STORAGE RACKS

A. Wall Storage Racks: Fabricate racks with chain restraints for upright cylinders as indicated or provide equivalent manufactured wall racks.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.

E. Install piping adjacent to equipment and specialties to allow service and maintenance.

F. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.

G. Install piping to permit valve servicing.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and for branch connections.

J. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.

K. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.

L. Install unions in copper tubing adjacent to each valve and at final connection to each specialty and piece of equipment.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 20 Section 20 05 00 "Common Work Results."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 20 Section 20 05 00 "Common Work Results."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 20 Section 20 05 00 "Common Work Results."

3.02 VALVE INSTALLATION

A. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.

B. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.

C. Install zone valves and gages in valve boxes. Arrange valves so largest valve is lowest. Rotate valves to angle that prevents closure of cover when valve is in closed position.

D. Install pressure regulators on gas piping where reduced pressure is required.

3.03 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.

B. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.

3.04 GAS SERVICE COMPONENT INSTALLATION

A. Assemble ceiling columns and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.

B. Assemble ceiling-hose assemblies and install anchored to substrate. Provide structural steel, hanger rods, anchors, and fasteners in addition to components furnished with specialties necessary to fabricate supports.

C. Install gas cylinders and connect to manifold piping.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 20 Section 20 05 48 "Vibration and Seismic Controls for Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 20 Section 20 05 29 "Hangers and Supports for Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or Type 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel, clevis hangers.
2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable, roller hangers.

E. Support horizontal piping within 12 inches of each fitting and coupling.

F. Rod diameter may be reduced one size for double-rod hangers, with 3/8 inch minimum rods.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 (DN 8): 60 inches with 3/8 inch rod.
2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches with 3/8 inch rod.
3. NPS 3/4 (DN 20): 84 inch with 3/8 inch rod.
4. NPS 1 (DN 25): 96 inches with 3/8 inch rod.
5. NPS 1-1/4 (DN 32): 108 inches with 3/8 inch rod.
6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8 inch rod.

3.06 IDENTIFICATION

A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Division 20 Section 20 05 53 "Mechanical Identification."

B. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:

1. Carbon Dioxide: Black or white letters on gray background.

3.07 FIELD QUALITY CONTROL FOR LABORATORY FACILITY SPECIALTY GAS

A. Testing Agency: Engage Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig (345 kPa) above system operating pressure, but not less than 150 psig (1035 kPa) . Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect specialty gas regulators for proper operation.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

D. Prepare test and inspection reports.

3.08 PROTECTION

A. Protect tubing from damage.

B. Retain sealing plugs in tubing, fittings, and specialties until installation.

C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.09 PIPING SCHEDULE

A. Medical Gas Piping except Medical Nitrogen Piping Larger Than NPS 3 (DN 80) and Operating at More Than 185 psig (1275 kPa): Type L, copper tube; wrought-copper fittings; and brazed joints.

B. Specialty Gas Piping except Specialty Gas Larger Than NPS 3 (DN 80) and Operating at More Than 185 psig (1275 kPa): Type L, copper tube; wrought-copper fittings; and brazed joints.

C. Specialty Gas Piping Larger Than NPS 3 (DN 80) and Operating at More Than 185 psig (1275 kPa): Type K, copper tube; wrought-copper fittings; and brazed joints.

3.10 VALVE SCHEDULE

A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B819, copper-tube extensions.

B. Zone Valves: Ball valve with manufacturer-installed ASTM B819, copper-tube extensions with pressure gage on one copper-tube extension.

3.11 APPLICATION

END OF SECTION 226313

SECTION 226600 - CHEMICAL-WASTE SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-Wall Pipe and Fittings.

B. Joining Materials.

C. Piping Specialties

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 ACTION SUBMITTALS

A. Product Data:

1. Pipe, fittings, tanks, manholes, joints, and related accessories.
2. Solvents and adhesives highlighting VOC content.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, 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 and approved by manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.05 COORDINATION

A. Coordination Drawings, Scaled:

1. Pipe sizes, locations, and elevations. Include associated reflected ceiling plan(s)
2. Interface and spatial relationship between piping and proximate structures.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, fittings, and seals from dirt and damage.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

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. NFPA Compliance: Comply with NFPA 70, "National Electrical Code."

2.02 PERFORMANCE REQUIREMENTS

A. Single-Wall Piping Pressure Rating: 10 feet head (3.05 m)of water for 30 minutes 5-psig (34.5-kPa) air test pressure.

2.03 SINGLE-WALL PIPE AND FITTINGS

A. PP Drainage Pipe and Fittings: ASTM F1412 , pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D4101; with fusion fusion- and mechanical -joint ends.

1. Exception: Pipe and fittings made from PP resin without fire-retardant additive may be used for underground installation.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Georg Fischer Inc.
    b. IPEX USA LLC.
    c. Orion Fittings; A WATTS Brand.
    d. Town & Country Plastics, Inc.
    e. Zurn Industries, LLC.
3. Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

2.04 JOINING MATERIALS

A. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

B. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

C. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

PART 3 EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Section 31 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

A. Chemical-Waste Piping Inside the Building:

1. Install piping next to equipment, accessories, and specialties to allow service and maintenance.
2. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
3. Flanges may be used on aboveground piping unless otherwise indicated.
4. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
5. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Verify final equipment locations for roughing-in.
11. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 20 Section 20 05 00 "Common Work Results."
12. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 20 Section 20 05 00 "Common Work Results."
13. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 20 Section 20 05 00 "Common Work Results."

3.03 JOINT CONSTRUCTION

A. Chemical-Waste Piping Inside the Building:

1. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according toASTM F1290 .
2. Fiberglass-Piping Joints: Make joints with piping manufacturer's bonded adhesive.
3. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.
4. Join high-silicon-iron, hub-and-plain-end piping with calked joints using acid-resistant packing and lead.
5. Join high-silicon-iron, mechanical-joint piping with coupled joints using clamps and sleeves.
6. PVC Nonpressure Piping Joints: Join piping according to ASTM D2665.

3.04 HANGER AND SUPPORT INSTALLATION

A. Pipe sizes in this article refer to aboveground, single-wall piping and carrier piping of containment piping.

B. Comply with requirements in Division 20 Section 20 05 48 "Vibration and Seismic Controls" for seismic-restraint devices.

C. Comply with requirements in Division 20 Section 20 05 29 "Hangers and Supports for Piping and Equipment" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet : MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet , if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

D. Comply with requirements in Division 20 Section 20 05 29 "Hangers and Supports for Piping and Equipment" for installation of supports.

E. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

F. Support vertical piping and tubing at base and at each floor.

G. Rod diameter may be reduced 1 size for double-rod hangers, to minimum of 3/8 inch.

H. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50): 33 inches with 3/8 inch rod.

2. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches with 1/2 inch rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches with 5/8 inch rod.
4. NPS 6 (DN 150): 48 inches with 3/4 inch rod.
5. NPS 8 (DN 200): 48 inches with 7/8 inch 7/8-inch (22-mm) rod.

I. Install supports for vertical PP piping every 72 inches.

J. Support piping and tubing not listed above in accordance with MSS SP-58.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make connections to existing piping so finished Work complies as nearly as practical with requirements specified for new Work.

C. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6 inches overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

D. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.

E. Install piping adjacent to equipment to allow service and maintenance.

3.06 LABELING AND IDENTIFICATION

A. Comply with requirements in Division 20 Section 20 05 53 "Mechanical Identification" for labeling of equipment and piping.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.07 FIELD QUALITY CONTROL

A. Inspect interior of sewerage 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. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between inspection points.
   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. Crushed, broken, cracked, or otherwise damaged piping.
   d. Hydrostatic Tests for Drainage Piping:

1) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/mm of nominal pipe size per kilometer) of pipe, during 24-hour period.
2) Close openings in system and fill with water.
3) Purge air and refill with water.
4) Disconnect water supply.
5) Test and inspect joints for leaks.

e. Air Tests for Drainage Piping: Comply with UNI B-6.
f. Provide tests for both primary pipe and containment conduit on double containment piping per manufacturer recommendations.

2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Submit separate reports for each test.

B. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

E. Tests and Inspections:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect assembled neutralization systems and their installation, including piping and electrical connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Chemical-waste piping will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.08 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Clean piping by flushing with potable water.

3.09 DEMONSTRATION AND TRAINING

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.

B. Provide fire rated insulation system for plastic piping located within return air plenum for any piping that does not have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E84.

C. Refer to “Plumbing Piping System Application Schedule” in drawings.

D. Single-Wall, Chemical-Waste Sewerage Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): PP drainage pipe and fittings and electrofusion joints.
2. NPS 6 (DN 150): PP drainage pipe and fittings and electrofusion joints.
3. NPS 6 (DN 150): CPVC drainage pipe and fittings and solvent-cemented joints.
4. NPS 8 to NPS 12 (DN 200 to DN 300): PP drainage pipe and fittings and electrofusion joints.

END OF SECTION 226600

SECTION 226713 - PROCESSED WATER PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

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 deionized-water and reverse-osmosis-water piping, fittings, and valves, including the following:

1. Polypropylene (PP) pipe and fittings.
2. Polypropylene (PP) Polypropylene valves.

B. Related Requirements:

1. Section 226719 “Process Water Equipment For Laboratory Facilities”
2. Stainless Steel piping and fittings for Animal Drinking Water

1.03 DEFINITIONS

A. RODI: Reverse osmosis, deionized.

B. ADW: Animal Drinking Water

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.05 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: For water piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Welding certificates.

C. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.3 for piping conveying fluid at a pressure of 15 psig or greater.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure Ratings:

1. RODI Piping: 150 psig unless otherwise indicated.

B. Seismic Performance: Water piping shall withstand the effects of earthquake motions determined in accordance with specification 220548.

1. The term "withstand" means "the piping system will remain in place without separation of any parts when subjected to the seismic forces specified and the piping system will be fully operational after the seismic event."
2. Component Importance Factor: 1

2.02 POLYPROPYLENE (PP) PIPE AND FITTINGS

A. Standards: Comply with NSF 14, NSF 61, FDA CFR 21 177.1520, USP 25 Class VI and ASME BPE.

B. PP Pipe and Fittings: Made from Class 1, Class 2 Beta Polypropylene Homopolymer.ASTM F2389, D4101, D638, D2837 and D2122. ASTM F2389 butt-fusion fittings.

1. PP Pipe and Fittings, Schedule 40: Schedule 40 or SDR 11 dimensions; with socket- or butt-fusion fittings matching pipe dimensions.
2. PP Pipe and Fittings, Schedule 80: Pipe made in accordance with ASTM D4101, D638, D2837, D2122, Schedule 80; with butt-weld fusion fittings matching pipe dimensions.
    a. ASTM F2389 socket weld fittings may be used as a substitute for butt-weld fusion fittings with client approval.

C. TRANSITION FITTINGS

1. Couplings, flanges, or other manufactured fittings; same size as, with pressure rating at least equal to, and ends compatible with piping to be joined.

D. PP Cone Check Valves:

1. Description:
    a. Pressure Rating: 150 psig at 73 deg F (23 deg C).
    b. Body Material: ASTM D4101 PP resin.
    c. Body Design: Conical.
    d. End Connections: Fusion Socket or Flanged.

e. Gasket and Seals: FKM/FPM

E. PP Diaphragm Valves:

1. Description: Georg Fischer Type 515
   a. Pressure Rating: 150 psig at 73 deg F (23 deg C).
   b. Body Material: ASTM D4101 PP resin.
   c. Body Design: Body nut
   d. End Connections for NPS 2 (DN 50) and Smaller: Detachable, socket.
   e. End Connections for NPS 2-1/2 and NPS 3 (DN 65 and DN 80): Flanged.
   f. Diaphragm: EPDM
   g. Seals: EPDM O-rings
   h. Handle: Wheel type.

F. Zero Static (Tee) POU Valve

1. Description: Georg Fischer Type 519
   a. Pressure Rating: 150 psig at 73 deg F (23 deg C).
   b. Body Material: ASTM D4101 PP resin.
   c. Body Design: T-Style – Zero Static
   d. End Connections: IR butt fusion spigot
   e. Diaphragm: EPDM
   f. O-Ring: EPDM O-rings
   g. Install as recommended by manufacturer, with port downward facing for drainage.

G. PP Pressure Reducing Valve:

1. Description: Georg Fischer Type 582, V82 or approved equivalent
   a. Pressure Rating: 150 psig at 73 deg F (23 deg C).
   b. Body Material: ASTM 4101 PP resin.
   c. Body Design: Bolted-bonnet type.
   d. End Connections: Fusion, union

H. PP Pressure Retaining Valve:

1. Description: Georg Fischer Type 586, V86 or approved equivalent
   a. Pressure Rating: 150 psig at 73 deg F (23 deg C).
   b. Body Material: ASTM D4101 PP resin.
   c. Body Design: Bolted-bonnet type.
   d. End Connections: Fusion, union

I. Recirculating Faucet (At Overhead Service Panel(s))

1. Description: WaterSaver Faucet – L7834MSC, Marquest Scientific NPT PP laboratory fixture or approved equivalent:

a. Pressure Rating: 150 psig (1035 kPa) at 73 deg F (23 deg C).
b. Body Material: Polypropylene-Lined
c. End Connections: Panel mounted application
d. Handle: White nylon knurled handle with color-coded index disc.
1) Stainless Steel Tubing for Animal Drinking Water (SSP2)
(a) SYSTEM RATING

2. Tubing shall not exceed 150 psig @ 300°F.
(a) TUBING CHEMISTRY
3. Type 316L stainless steel tubing ASTM A269
4. Seamless or welded
5. Allowable sulfur range 0.005 - 0.017%
(a) TUBING DIMENSIONS
6. 1/2" through 3" OD x 0.065" nominal wall thickness
7. Tubing dimensions shall conform to ASTM A269
(a) TUBING FINISH
8. Standard manufacturer's finish for tubing interior and exterior.
(a) FITTINGS
9. Tube fitting material, thickness, and finish are to be as specified for adjacent tubing. Long tangent type weld fittings are to be utilized for automatic machine welding.
10. All fittings shall comply with ASME BPE Part DT.
11. Custom made fittings are to be manufactured to the material grade and finish as adjacent tubing. Identical or similar heat lot numbers will be used whenever possible. Tolerances for fittings and ferrules fabricated from tubing are to conform to ASTM A269, and A270
12. Bending of tubing 1/2" and smaller is acceptable. Minimum bend radius shall be 3 times the normal tube diameter.
(a) JOINTS
13. Buttweld in inaccessible or hidden areas
14. 1/2" through 1" compression type connections. Threaded NPT adapters can be used to connect equipment or accessories.
(a) GASKETS AND ELASTOMERS
15. Material in contact with the process shall be USP Class VI EPDM or approved equivalent.
16. Flange gaskets shall be 1/16" thick, 150 lb. class, ring type, EPDM, or approved equivalent except for steam service which shall be Flexitalic or approved equivalent.
(a) VALVES, Ball
17. Valve material, weld-end thickness, and surface finish are to be compatible with specified adjacent tubing.
18. For gas service, 1/2" through 1": butt weld or compression ends for OD tube, 3-piece design, 316L stainless steel body, ball, and trim, reinforced Teflon seats and seals, lever operated with built in lockout feature.
19. 1-1/2" through 2": butt weld ends for OD tube, 3-piece design, 316L stainless steel body, ball, and trim, reinforced Teflon seats and seals, lever operated with built in lockout feature.
(a) VALVES, Check

20. Valve material, weld-end thickness, and surface finish are to be compatible with specified adjacent tubing.
21. For gas services, 1/2" through 1": 316 stainless steel body, bonded poppet design, compression fitting.
22. 1" through 3": 316 stainless steel body, spring loaded, disk type, 316 stainless steel spider, spring and disc, 316L stainless steel body clamp, Tri-clamp ends.
    (a) DOCUMENTATION
23. Manufacturer's cut sheet. Certificates of compliance are to be furnished for all equipment, components, and elastomers. Components used for compressed air, nitrogen, oxygen, and carbon dioxide must have documentation indicating the items have been cleaned for oxygen service.
    (a) CLEANING & PACKAGING
24. Tubing, fittings, valves and accessories shall be cleaned of manufacturing oils and debris.
25. After cleaning, materials shall be packaged by acceptable method until the item is ready for installation.
    (a) NOTES:
26. All liquid lines of 3/4" diameter and greater shall have positive slope of at least 1/8" per foot. 1/2" diameter lines shall have a positive slope of at least 1/4" per foot. Short runs at valve manifolds can be horizontal.
27. All welded joints to be made with tungsten, inert gas, fusion welding (interior and exterior) machine or machine with equal weld controllability.
28. All items that are assigned a tag number on the P&ID shall be permanently identified with stainless steel tags attached with stainless steel wire.
29. Each valve shall be identified per Section 220553 – Identification for Process Piping and Equipment.
30. All diaphragm, O-ring, and gasket material must be approved by the Owner’s QA department prior to use.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING

A. General Locations and Arrangements: Drawing and details indicate general location and arrangement of water piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for removal of ceiling panel, and coordinate with other services occupying that space.

F. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure ratings unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Heat fusion joining of Polypropylene (PP) pipe and fittings shall comply with ASTM F3722.

3.03 INSTALLATION OF VALVES

A. Locate valves for easy access and provide separate support where necessary.

B. Install valves of same size as the pipe or tube in which they are installed unless otherwise indicated.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full movement of stem and lever handle.

E. Install swing-check valves in horizontal position with the hinge pin level.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Clamps for Vertical Piping: MSS Type 8 or Type 42.
6. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet (30 m) and Less: MSS Type 1 adjustable clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43 adjustable roller hangers.
   c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49 spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs, 100 Feet (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.

C. Install padded hangers for PP piping with maximum horizontal spacing and minimum rod diameters to comply with MSS-SP-58, manufacturer's written recommendations and 2020 New York State Plumbing Code. Where differences apply, the more stringent requirement must be followed.

D. Install padded hangers for glass piping with maximum horizontal spacing and minimum rod diameters to comply with MSS SP-58, manufacturer's written recommendations, and 2020 New York State Plumbing Code. Where differences apply, the more stringent requirement must be followed.

E. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

F. Support vertical runs of PP piping to comply with MSS-SP-58, manufacturer's written recommendations and 2020 New York State Plumbing Code. Where differences apply, the more stringent requirement must be followed.

3.05 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

C. Connect deionized-water and RO water piping to equipment and service outlets with unions and flanges.

3.06 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Test new piping and parts of existing piping that have been altered, extended, or repaired for leaks and defects.
2. Schedule tests and their inspections by Owner, with at least 24 hours' advance notice.
3. Do not cover piping or put into service before inspection and approval by the engineer or Owner.
4. Test completed piping in accordance with Owner. If Owner does not have published procedures, perform tests as follows:
    a. Hydrostatic Tests: Test piping at pressure of not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa). Hold test for two hours; pressure shall remain constant without pumping. Inspect system to determine visible leaks or significant pressure variations.
        1) Exception: Do not subject glass piping to pressure above manufacturer's pressure rating for size.
5. If piping does not pass the test, replace leaking joints with new materials and retest until no leaks exist.
6. Submit separate reports for each test.

F. Processed-water system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.08 CLEANING OF PIPING SERVING LABORATORIES

A. Use procedures prescribed by Owner or, if not prescribed, use procedures described below:

1. Before using, purge new piping and parts of existing piping that have been altered, extended, or repaired.
2. Remove flow indicators and flow-measuring devices before flushing. Replace after cleaning is completed.
3. Provide storage tank(s), heat exchanger(s) and pumping system(s) required for cleaning.
4. Clean piping by pumping at a sufficient velocity and quantity to dislodge sediment or dirt with sodium hypochlorite and deionized- and RO- water mixture throughout the system.
5. Open all taps until cleaning solution is detected, then close taps. Retain solution in the system at least four hours.

B. At the end of the retention period, open all faucets and taps to thoroughly flush with clean deionized- and RO water until solution is drained from the system.

3.09 PIPING APPLICATION

A. Transition and special fittings with pressure ratings at least equal to piping, and of same or compatible material, may be used in applications below.

B. Pipe fittings shall be the same material as the piping to which it is connected.

C. RODI Piping: Use any of the following piping materials for each pipe size range:

1. NPS 4 (DN 80) and Smaller: PP pipe and fittings and heat-fusion joints.

D. ADW Piping

1. NPS 2” and smaller: Stainless Steel Tube 316 L

3.10 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Valves shall be the same material as the piping to which they are connected.
2. Shutoff Duty: Install diaphragm valves for NPS 4 (DN 80) and smaller piping.
3. Throttling Duty: Install diaphragm valves for NPS 4 (DN 80) and smaller piping.

END OF SECTION 226713

SECTION 230130.51 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

B. Testing and inspection agency employed by Owner.

1.02 REFERENCE STANDARDS

A. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC Systems; 2025.

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

C. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Project Cleanliness Evaluation and Cleaning Plan, as specified.

C. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.04 QUALITY ASSURANCE

A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.

1. Certified by one of the following:
   a. NADCA, National Air Duct Cleaners Association: www.nadca.com.
2. Having minimum of three years documented experience.
3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 REPLACEMENT PRODUCTS

A. Fibrous Glass Insulation: Provide material complying with UL 181 equivalent to existing material in quality and thickness.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. The project requires that the exhaust riser that served the previously existing cage wash area associated with EF-15/16 shall be cleaned and sterilized. The duct riser is anticipated to contain allergens, dander, and biocontaminants. Contractor to submit a plan that adequately cleans and sterilizes duct, for Engineer and Owner review and approval.

B. Comply with applicable federal, state, and local requirements.

C. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

D. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

E. Take precautions to prevent introduction of additional hazards into occupied spaces.

F. Obtain Owner's approval of proposed temporary locations for large equipment.

G. Designate a decontamination area and obtain Owner's approval.

H. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

I. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Prior to the commencement of any cleaning work, prepare and submit to Architect a project evaluation and plan for this project, including considerations recommended in NADCA ACR.

B. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

C. Start of cleaning work constitutes acceptance of existing conditions.

D. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

E. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.

1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Fibrous Glass Material: Use HEPA vacuuming equipment, under constant negative pressure, do not permit to get wet, and do not damage surfaces; replace material damaged by cleaning operations.

H. Existing Damaged Fibrous Glass Material: Report to Architect all evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture that cannot be remedied by cleaning or resurfacing with an acceptable insulation repair coating.

1. Remove unremediable material and clean underlying surfaces.

I. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

J. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Architect when cleaned components are ready for inspection.

E. Notify Owner's testing and inspection agency when cleaned components are ready for inspection.

F. Owner reserves the right to verify cleanliness using NADCA ACR Surface Comparison Testing or NADCA Vacuum Test.

G. When directed, re-clean components until they pass.

H. Contractor shall bear the costs of retesting due to inadequate cleaning.

I. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.08 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006 inch thick polyethylene plastic bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

END OF SECTION 230130.51

SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Flex-Weld, Inc: www.kelcoind.com/#sle.
2. FNW: www.fnw.com/#sle.

END OF SECTION 230516

SECTION 230519 - METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges

B. Thermometers and thermometer wells.

C. Static pressure gauges.

D. Filter gauges.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 230923 - Direct-Digital Control System for HVAC.

B. Section 230993 - Sequence of Operations for HVAC Controls.

C. Section 232113 - Hydronic Piping.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2026).

B. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

C. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2025).

D. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2025).

E. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

F. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data Submittals: For each product.

C. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

D. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.

E. Product description with complete technical data, performance curves, and product specification sheets.

F. Installation operation and maintenance instructions, including factors affecting performance.

G. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn stainless steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Stainless steel case, non-repairable
2. Media: silicone filled.
3. Size: 3-1/2 inch diameter.
4. Mid-Scale Accuracy: One percent.
5. Scale: Psi.
6. Subbers: Not allowed.
7. Gauge Valve: Shut-off ball valve (gauge cocks are not permitted).

2.02 STEM TYPE THERMOMETERS

A. Thermometers - Industrial stick type, 9" aluminum or non-metallic case, locking adjustable angle body, mercury free; ASTM E1.

1. Size: 9 inch scale.
2. Stem: 3/4 inch NPT brass.

3. Secured to thermowell by tapered bushing (not by set screws).
4. Accuracy: 1 percent, per ASTM E77.
5. Calibration: Degrees F.

B. Thermometers - Adjustable Angle: Digital Light-powered digital with aluminum or high impact ABS plastic case, glass passivated thermistor, LCD display, 0.5-inch minimum digits.

1. Size: 9 inch scale.
2. Stem: 3/4 inch (20 mm) NPT brass.
3. Secured to thermowell by tapered bushing (not by set screws).
4. Accuracy: 1 percent, per ASTM E77.
5. Calibration: Degrees F.

2.03 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.04 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

1. Pressure/temperature test ports shall be provided on each coil bank, heat exchanger, fan coil, and at all permanent pressure gauge locations. Use extended body style to allow for insulation thickness. Seals shall be appropriate for operating water temperature and pressure as follows:
   a. Hot Water, Glycol => Nordel (EPDM)
2. Cold Water, Chilled Water => Neoprene

2.05 STATIC PRESSURE GAUGES

A. Case: stainless steel case, non-repairable

B. Dial Size: 3.5" min

C. Media: Silicone filled

D. Accuracy: 1%

E. Gauge Valve: Shut-off ball valve (gauge cocks are not permitted).

F. Snubbers: Not allowed

PART 3 EXECUTION

3.01 INSTALLATION

A. Install meters and gauges at all required locations as shown on Project Documents, in addition to as described below.

B. Pressure/temperature test ports shall be provided on each coil bank, heat exchanger, fan coil, and at all permanent pressure gauge locations. Use extended body style to allow for insulation thickness. Seals shall be appropriate for operating water temperature and pressure as follows:

1. Hot Water, Glycol => Nordel (EPDM)
2. Cold Water, Chilled Water => Neoprene

C. Install in accordance with manufacturer's instructions.

D. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 230943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bronze Ball Valves

1. Two-Piece, Full-Port with Stainless Steel Trim.

B. Iron, Single-Flange Butterfly Valves.

1. 150 CWP with EPDM Seat and Stainless-Steel Disc.

C. Bronze Lift Check Valves.

1. Class 125 with Bronze Disc.
2. Class 125 with Nonmetallic Disc.

D. Bronze Swing Check Valves.

1. Class 125 with Bronze Disc.
2. Class 125 with Nonmetallic Disc.

E. Drain Valves.

F. Air Vent Valves

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels.

C. Section 230548 - Vibration and Seismic Controls for HVAC.

D. Section 230553 - Identification for HVAC Piping and Equipment.

E. Section 230716 - HVAC Equipment Insulation.

F. Section 230719 - HVAC Piping Insulation.

G. Section 232113 - Hydronic Piping.

1.04 REFERENCE STANDARDS

A. ASME B1.20.7 - Hose Coupling Screw Threads (Inch); 1991 (Reaffirmed 2018).

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).

C. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).

D. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

E. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2021.

F. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

G. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.05 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

J. WSP: Working steam pressure.

1.06 SUBMITTALS

A. Action Submittals

1. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Operation and Maintenance Materials

1. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.07 DELIVERY, STORAGE AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Valve Actuator Types:
4. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:

1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

1.08 EXTRA MATERIALS

A. Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

PART 2 PRODUCTS

2.01 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze or Lead-Free Bronze Ball Valves with 316 Stainless Steel Trim:

1. Manufacturers
   a. Apollo (Conbraco): 77-140, 77-240, 77CLF-140
   b. Nibco: T-585-70-66, S-585-70-66, T-585HP-66-LF
   c. Watts: LFB6080-G2-SS
2. Description:
   a. Standard: MSS SP-110.
   b. WOG Rating: 300 PSIG minimum
   c.
   d. Body Design: Two piece.
   e. Body Material: Bronze or Lead-Free Bonze.
   f. Ends: Soldered on bronze; Threaded on lead-free.
   g. Seats: Reinforced Teflon (RTFE), 15% glass filled double seal.
   h. Stem: 316 Stainless Steel.
   i. Ball: 316 Stainless Steel.
   j. Port: Full.
   k. Handle: Lever Actuated.

2.02 BUTTERFLY VALVES

A. Class 150, Single-Flange, Butterfly Valves:

1. Acceptable Models:
   a. Keystone: Series 60
   b. Nibco: LD-3022
   c. Watts: BF-03
2. For all water services and all other normal non-corrosive services, butterfly valves shall be single offset, and have the following requirements:
3. Description:
   a. Standard: MSS SP-68.
   b. Body Design: Fully lugged.
   c. Body Material: Ductile iron or cast iron.
   d. Trim: 316 or 17-4 pH Stainless Steel.
   e. Seat: EPDM. Resilient seat fully bi-directional dead-endable.
   f. Seat Working P/T Rating: 150 psig @ 250F Minimum.
   g. Body Working P/T Rating: ANSI 150.
   h. Stem: Stainless steel; offset from seat plane.
   i. Disc: Stainless steel.
   j. Actuator:
      1) Under 4" - Locking Lever Handle

2) 4" and Above - Handwheel Gear Operator.

4. Please note: In order to provide the standard required body/disc materials, it is often necessary to exceed the ANSI 150 Body Working P/T rating.

2.03 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc - for applications 2-1/2" and over:

1. Non-slam type globe style lift check, non-slam type tilting disk or wafer body, non-slam type lift check. Double disk or bi-folding disc type valves are not acceptable.
2. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B61 or ASTM B62, bronze.
   e. Ends: Threaded.
   f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc: - for applications 2-1/2" and over::

1. Non-slam type globe style lift check, non-slam type tilting disk or wafer body, non-slam type lift check. Double disk or bi-folding disc type valves are not acceptable.
2. Description:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig.
   c. Body Design: Vertical flow.
   d. Body Material: ASTM B61 or ASTM B62, bronze.
   e. Ends: Threaded.
   f. Disc: NBR, PTFE, or TFE.

2.04 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc - for applications 2" and under:

1. 45-degree swing check
2. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B62, bronze.
   e. Ends: Screwed.
   f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc - for applications 2" and under:

1. 45-degree swing check
2. Description:
    a. Standard: MSS SP-80, Type 4.
    b. CWP Rating: 200 psig.
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B62, bronze.
    e. Ends: Threaded.
    f. Disc: PTFE or TFE.

2.05 DRAIN AND HOSE CONNECTION VALVES

A. Ball-Valve-Type, Hose-End Drain Valves - 1/2" and 3/4" hose connection ball valves shall be as follows:

1. Body: Bronze
2. Body Style: Full Port, Two-Piece
3. Trim: 316 Stainless Steel Ball and Stem
4. Seat: PTFE or TFE
5. Seat Working P/T Rating: 300 psig @ 250F Minimum
6. WOG Rating: 300 psig Minimum
7. SWP Rating: 150 psig Minimum
8. Acceptable Models
    a. Apollo (Conbraco): 70LF-140-HC
    b. Nibco: T-585-66-LF-HC
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.06 AIR VENT VALVES

A. On chilled water and glycol service use manual vents only. Do not use automatic vents.

PART 3 EXECUTION

3.01 APPLICATION

A. Unless otherwise noted, all valves for shut-off and bypass service shall be as follows:

1. NPS 2-inch and below: Ball valves with thread, sweat, socket weld connections.
2. NPS 2-1/2 inch and above: Butterfly valves with flanged/lugged connections.
3. 2-1/2-inch and 3-inch copper piping systems: Ball valves with sweat or threaded connections
4. Piping systems with press-fit fittings: The use of valves with press-fit connections are NOT ALLOWED under any circumstances. Valves shall have thread or sweat connections.

B. Valves for balancing operations shall not be ball or butterfly.

C. Valves with solder joints shall have fully removable seats and internal components to avoid heat damage during installation.

D. All valves shall be labeled with 1-1/2-inch brass tags bearing a letter to indicate the service and a number to indicate the valve. A permanent valve chart and system schematic diagram shall be submitted for approval that shows the location of all valves.

E. A manufacturer's valve tag shall be on all valves identifying the valve type and major component materials.

F. Install valves after welding adjacent to valve is completed to protect seat and disk.

G. Insulated valves shall have extended handle stems.

H. All valves shall be fully bi-directional and suitable for dead end service.

I. Valve 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.

J. Plug or gate valves shall not be used.

K. All valves used for vent or drain service on water systems shall have a brass hose connection with cap and chain.

L. On chilled water and glycol service use manual vents only. Do not use automatic vents.

3.02 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.03 INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

3.04 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 230548 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. 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.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MFMA-4 - Metal Framing Standards Publication; 2004.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications for Field-Welding: As specified in Section 055000.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported in accordance with MSS SP 58. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:

1. Strut Channel or Bracket Material:
2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Hanger Rods:

1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch diameter.
    b. Piping up to 1 inch: 1/4 inch diameter.
    c. Piping larger than 1 inch: 3/8 inch diameter.
    d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D. Thermal Insulated Pipe Supports:

1. General Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.
   d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   c. Thickness: 60 mil.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

E. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.

F. Pipe Stanchions:

1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

G. Beam Clamps:

1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,

7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

H. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

I. U-Bolts:

1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

J. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

K. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

L. Insulation Clamps:

1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

M. Pipe Hangers:

1. Split Ring Hangers:
   a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
   b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   c. Provide hanger rod and nuts of the same type and material for a given pipe run.
   d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
2. Band Hangers, Adjustable:
   a. MSS SP-58 Type 7 or 9, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
3. J-Hangers, Adjustable:
   a. MSS SP-58 Type 5, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
4. Swivel Ring Hangers, Adjustable:

a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.
b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

5. Clevis Hangers, Adjustable:
a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
b. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
c. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
d. UL (DIR) listed: Pipe sizes 2-1/2 to 8 inch.
e. FM (AG) listed: Pipe sizes 2-1/2 to 8 inch.

N. Intermediate Pipe Guides:

1. Pipe Diameter 6 inch and Smaller: Provide minimum clearance of 0.16 inch.
2. Pipe Sizes 8 inch: 0.625 inch U-bolt with double nuts providing minimum clearance of 0.28 inch.
3. Pipe Size 10 inch: 0.75 inch U-bolt.
4. Pipe Sizes 12 to 16 inch: 0.875 inch U-bolt.
5. Pipe Sizes 18 to 30 inch: 1 inch U-bolt.
6. Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

O. Pipe Alignment Guides:

1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
2. Pipe Sizes 10 inch and Larger: Roller type.

P. Pipe Shields for Insulated Piping:

1. MSS SP-58 Type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel
2. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Minimum Service Temperature: Minus 40 degrees F.
e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

Q. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
7. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.
8. Sheet Metal: Use sheet metal screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

R. Pipe Installation Accessories:

1. Thermal Insulated, Surface-Mounted Pipe Supports:
    a. Material: Carbon steel with epoxy copper or zinc finish.
    b. Weather and UV light resistant foam, plastic, or rubber material with built-in strut. Maximum Load: 50 lb for single pipe or multiple landed on top strut.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Piping shall be supported at distances not exceeding the spacing in accordance with ANSI/MSS-SP-58.

B. Install products in accordance with manufacturer's instructions.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Field-Welding (where approved by Architect): Comply with Section 055000.

H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

I. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

K. Secure fasteners according to manufacturer's recommended torque settings.

L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

D. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

E. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. MFMA-4 - Metal Framing Standards Publication; 2004.

F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

D. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

E. Field quality control test reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

D. Equipment Isolation: As indicated on drawings.

E. Piping Isolation:

1. Provide vibration isolators for piping supports:
   a. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
   b. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
2. Minimum Static Deflection:
   a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
   b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
3. Suspended Piping, Non-Seismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.

2.02 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.

B. Vibration Isolators for Non-Seismic Applications:

1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.

c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

2. Resilient Material Isolator Mounts, Non-Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
   b. Furnished with integral elastomeric snubbing elements, non-adjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
   c. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   d. Furnished with integral leveling device for positioning and securing supported equipment.
4. Restrained Spring Isolators, Non-Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
5. Resilient Material Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
6. Spring Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.
7. Combination Resilient Material/Spring Isolator Hangers, Non-Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Spring Isolators:
    a. Position equipment at operating height; provide temporary blocking as required.
    b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
    c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
2. Isolator Hangers:
    a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
    b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
3. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.
4. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.
5. Adjust isolators to be free of isolation short circuits during normal operation.
6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.

D. Vibration Isolation Systems:

1. Verify isolator static deflections.
2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Control Panels: Nameplates.

D. Ductwork: Adhesive labels.

E. Heat Transfer Equipment: Nameplates.

F. Instrumentation: Tags.

G. Major Control Components: Nameplates.

H. Piping: Tags.

I. Pumps: Nameplates.

J. Small-sized Equipment: Tags.

K. Thermostats: Label.

L. Valves: Tags.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch.

C. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: In alignment with ANSI/ASTM A13.1 Standards.

D. Size: In alignment with ANSI/ASTM A13.1 Standards.

E. Minimum information indicating flow direction arrow, identification of air type being conveyed, and equipment duct is connected to (air handler or fan system).

2.05 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.

F. Pipe marker installation requirements:

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install ductwork with adhesive labels. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-balancing of air systems.

B. Pre-balancing of hydronic systems.

C. Testing, adjustment, and balancing of air systems.

D. Testing, adjustment, and balancing of hydronic systems.

E. Field quality-control testing of Laboratory fume hoods.

F. Measurement of final operating condition of HVAC systems.

G. Commissioning activities.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Employment of testing agency and payment for services.

B. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

C. Section 230800 - Commissioning of HVAC.

1.04 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016, with Errata.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024.

D. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2026.

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
3. Include at least the following in the plan:
    a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    c. Identification and types of measurement instruments to be used and their most recent calibration date.
    d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    e. Final test report forms to be used.
    f. Detailed step-by-step procedures for TAB work for each system and issue, including:
        1) Terminal flow calibration (for each terminal type).
        2) Diffuser proportioning.
        3) Branch/submain proportioning.
        4) Total flow calculations.
        5) Rechecking.
        6) Diversity issues.
    g. Details of how TOTAL flow will be determined; for example:
        1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
        2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
    h. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
    i. Confirmation of understanding of the outside air ventilation criteria under all conditions.
    j. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

k. Method of checking building static and exhaust fan and/or relief damper capacity.
l. Methods for making coil or other system plant capacity measurements, if specified.
m. Time schedule for TAB work to be done in phases (by floor, etc.).
n. Time schedule for deferred or seasonal TAB work, if specified.
o. False loading of systems to complete TAB work, if specified.
p. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
q. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
r. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Quality-control Testing of Laboratory Fume Hoods:

1. Product Data sheets for all equipment proposed for use in on-site as-installed testing.
2. List of laboratory fume hoods to be tested. Submit a minimum of one week prior to commencement of testing.
3. Test data demonstrating that each type of fume hood provided for the project has been successfully tested in the factory as per requirements of Section 115313.

D. Field Logs: Submit at least twice a week to the Commissioning Authority.

E. Test Reports: Indicate pressure tests performed.

1. Ductwork: Include date, section tested, test pressure, and leakage rate per appropriate seal class for ductwork, following SMACNA for ductwork. See Leakage Testing Section of Specification Section 233100 "HVAC DUCTS AND CASINGS" for additional information.
2. Piping: Include date, system tested, test pressure, and test duration. There should be zero leakage.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
2. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
    a. AABC, Associated Air Balance Council: upon completion submit AABC National Performance Guaranty.
    b. NEBB, National Environmental Balancing Bureau.
    c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 PRECONSTRUCTION PREBALANCING OF AIR SYSTEMS

A. Prior to any demolition or construction activity, complete airflow measurements of the AHU-9 and AHU-9A systems, as well as the EF-10, EF-11, EF-12, EF-13, EF-14, EF-15, EF-16, EF-19, EF-19A, EF-20 AND EF-21 systems to document the airflow leakage through the ductwork as well as the supply air delivered through each diffuser and the exhaust air extracted through each exhaust grill (or other exhaust removal points. Do not adjust any equipment prior to taking these measurements.

1. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
2. Measure air quantities at air inlets and outlets.
3. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
4. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan.
5. Where variable variable volume systems exist, measure at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
6. Document operational flowrates and static pressures of each air handler and exhaust fan.

3.03 PRECONSTRUCTION PREBALANCING OF HYDRONIC SYSTEMS

A. Prior to any demolition or construction activity, complete hydronic measurements of heating, cooling coils associated with AHU-9 and AHU-9A, as well as reheat coils in the aquatics vivarium area served by the AHU-9 and AHU-9A systems where existing reheat coils are to be reused.

1. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance.
2. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
3. Perform balancing by measurement of temperature differential in conjunction with air balancing.
4. Do not use service or shut-off valves for balancing unless indexed for balance point.
5. Document operational flowrates and differential pressures of each coil.

3.04 PRECONSTRUCTION DUCT LEAKAGE TESTING

A. Perform duct leakage testing of the entire supply ductwork system associated with AHU-9 and AHU-9A in alignment with Specification 233100 - HVAC Ducts and Casings Section 3.03, and submit testing results to Owner and Engineer for review. If duct leakage falls below Testing Acceptance Criteria listed in said specification, perform duct sealing to reduce leakage to acceptable range.

3.05 PIPING PRESSURE TESTING

A. Hydronic piping systems shall be tested hydrostatically at one and on-half times the maximum system design pressure, but not less than 100 psi. The duration of each test shall not be less than 1 hour.

B. As far as is practicable, all pressure tests shall be complete system tests conducted with all parties present. Pressure vessels, instruments and equipment connected to the piping may be included in the test if their rated test pressure is not exceeded by the piping system test pressure. It is the Owner’s option to exclude certain equipment or devices from testing based on practicality or manufacturer’s recommendations.

C. Every precaution shall be taken during testing to ensure the safety of the test operator and other personnel working in the area. Systems to be pressurized shall be provided with appropriate gauges and pressure relieving devices.

D. All joints, including welds, are to be left uninsulated, unpainted, and exposed for examination during testing.

E. Equipment and/or instrumentation which are not to be subjected to the pressure test shall be either disconnected from the piping or isolated by blinds or other means during the test. Valves may be used provided the valve is suitable for the proposed test pressure.

F. Pressure gauges shall not be subjected to pressure in excess of their scale range. All pieces of equipment which do not have their test pressure indicated or whose test pressures are below the piping system test pressure shall be excluded from these tests.

G. Pressure relief and thermal relief devices which are part of the piping system shall be excluded from these tests either by removal or isolated by test blinds.

H. Before every test, the piping and tubing systems shall be visually inspected to assure that there are no obvious defects and that all connections are tight.

I. Control valves, unless being tested, shall be set and maintained in the open position.

J. Lines that are spring or counterweight supported and all vapor or gas lines shall be temporarily supported during the test in order to support the test fluid load, if necessary.

K. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat. If this is not practical, the check valve disc shall be locked open or removed for the test.

L. All in-line instruments, gauge glasses, flow meter pots, liquid level float gauges, and all other pressure parts of instruments shall be included in these tests, where feasible. Joints found to be defective shall be repaired and retested.

M. Retesting of lines after repairs shall be done at pressure originally specified for the test. At the completion of the test; all blinds, plugs, caps, etc., used to isolate vessels, instruments, etc. shall be removed; flange faces and threads inspected for damage and piping reconnected.

N. Gaskets removed after tests shall not be reused. Special care shall be exercised when reconnecting these points to avoid leaks.

O. Perform prior to covering pipe with insulation.

P. Witness the pipe pressure testing performed by Installer.

Q. Verify that proper test methods are used and that leakage rates are within specified limits.

R. Report and mitigate deficiencies observed.

3.06 DUCTWORK PRESSURE AND LEAKAGE TESTING

A. See specification section 233100 "HVAC DUCTS AND CASINGS" for information.

3.07 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.

6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.08 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

D. Perform system-readiness checks of systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Verify leakage and pressure tests on distribution systems have been satisfactorily completed in accordance with applicable code and authority having jurisdiction.
2. Piping and ductwork is complete and all points of outlet are installed.
3. Water treatment is complete.
4. Piping systems are flushed, filled, and air purged. Duct systems are cleaned and filters have been installed.
5. Strainers are clean.
6. Control valves and dampers are functioning in accordance with the sequence of operation.
7. Shutoff and balance valves and dampers are 100 percent open.
8. Pumps and fans are operational and proper rotation is verified.
9. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers. Static pressure sensors are installed as indicated.
10. Variable-frequency controllers' startup is complete and safeties are verified.
11. Suitable access to balancing devices and equipment is provided.

3.09 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.10 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.11 FUME HOOD TESTING (ON SITE)

A. General: Test fume hoods as installed to assess airflow velocity, airflow visualization, and level of containment. Perform tests with dynamic mode (sash movement effect) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.

1. Hoods with combination sashes shall be tested in both vertical and horizontal sash positions and shall include dynamic sash movement containment tests.
2. Testing of occupied and unoccupied modes shall be incorporated.

B. Acceptance Criteria:

C. - Exhaust Airflow and the fume hood face velocity shall be within ±5% of setpoint.

D. - The range shall not be more than 15 fpm between the high/low face velocity readings for each hood.

E. - ASHRAE Standard 110 Static Performance Rating: AI 0.05

F. - ASHRAE Standard 110 Sash Movement Performance Rating: SME-AI 0.05

G. c. 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 setpoints can be finalized – all of which will avoid multiple trips during project close-out.

H. Testing to be performed by firm certified by National Environmental Balancing Bureau - NEBB (FHT).

I. Preparation: Visit the project site to confirm that construction activities related to the fume hood system(s) and equipment are complete. Review design documents and Contractor's submittals. Verify that mechanical ventilation systems serving the space are functioning and operating in the normal mode. Notify Owner in writing, if conditions exist which preclude proper fume hood testing. Starting of testing constitutes acceptance of site conditions.

J. Testing Requirements:

1. Perform the following tests, in order:
    a. Airflow Velocity Test.
    b. Airflow Visualization Test.
    c. Tracer Gas Containment Test.
2. If more than one test procedure is selected, proceed to the next test only if any unsafe condition discovered during current test has been successfully rectified.
3. Airflow Velocity Test: Comply with Section 9 of NEBB (FHT) Fume Hood Testing Standard - current edition.
4. Airflow Visualization Test: Comply with Section 10 of NEBB (FHT) Fume Hood Testing Standard - current edition.
5. Tracer Gas Containment Test:
    a. Conduct a static mode test of the hood and laboratory configuration. Conduct testing in accordance with ASHRAE Std 110, except as modified herein:
        1) Test hood with simulated scientific apparatus set-up within the hood. Apparatus to consist of: two (2) each 1 gal. round paint cans, one (1) 1' by 1' by 1' cardboard box, and three (3) each 6" by 6" by 12" high cardboard boxes. Position these items from 6 to 10 inches behind the sash, randomly distributed, and supported off of the work surface by 2 inch by 2 inch by 2 inch block of any material.
        2) 6 liters per minute release rate for tracer gas.
        3) Conduct only at the center position for the manikin.
        4) Each tracer gas test duration to be 5 minutes.

5) Acceptable test results will be 0.05 PPM or better.
6) At the conclusion of each 5-minute test there will be three rapid walk-by at 1' behind the manikin. Each walk-by to be spaced 30 seconds apart. If a rise in test gas concentration occurs, it cannot exceed 0.10 ppm and must return to 0.05 ppm within 15 seconds.
7) There must be a minimum of three and a maximum of five people in the space in which the fume hood is located during the test procedure.
8) Representatives of the Architect, Engineer, Owner, and Contractor must witness the tests.
9) Test of Alarm: Shut off the fume hood exhaust and verify that the individual fume hood alarm activates.
10) Test individual controls: Test any controls that are provided at the fume hood such as unoccupied cycle override, alarm override, etc.

b. Conduct a dynamic mode test of the hood to measure performance parameters of fume hood control systems during the following test events:
1) Sash movement: 25 percent to 100 percent, and 50 percent to 100 percent operating positions.
2) Rapid walk-by in front of the hood. Conduct only at center position for the manikin.
3) Opening and closing main space entrance door, to simulate a person entering or exiting the space.

c. Hoods with combination sashes shall be tested in both vertical and horizontal sash positions and shall include dynamic sash movement containment tests.
d. Testing of occupied and unoccupied modes shall be incorporated.

6. Acceptance Criteria:
a. Exhaust Airflow and the fume hood face velocity shall be within ±5% of setpoint.
b. The range shall not be more than 15 fpm between the high/low face velocity readings for each hood.
c. ASHRAE Standard 110 Static Performance Rating: AI 0.05
d. ASHRAE Standard 110 Sash Movement Performance Rating: SME-AI 0.05
e. 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 setpoints can be finalized – all of which will avoid multiple trips during project close-out.

3.12 AIR SYSTEM PROCEDURE

A. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

B. Measure air quantities at air inlets and outlets.

C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

I. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

J. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

L. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.13 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.14 COMMISSIONING

A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:

1. Air side systems.
2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 50 percent of the air handlers plus a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:
    a. Air Flow of Supply and Exhaust Deviation of more than 10 percent of instrument reading.
    b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    c. Temperatures: Deviation of more than one degree F.
    d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
    e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.15 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:

1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.

11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Cooling Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

E. Heating Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

F. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.

7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

G. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

H. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

I. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:

a. Blower.
b. Orifice, tube size.
c. Orifice size.
d. Calibrated.

7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

J. Terminal Unit Data:

1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

K. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Design velocity.
6. Design air flow.
7. Test (final) velocity.
8. Test (final) air flow.
9. Percent of design air flow.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 078400 - Firestopping.

C. Section 099123 - Interior Painting: Painting insulation jackets.

D. Section 230553 - Identification for HVAC Piping and Equipment.

1.03 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; 2024.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

D. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

G. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

H. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

I. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mouting procedures of ASTM E2231. Pipe and duct insulation shall not flame, glow, smolder, or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250F. Pipe and duct insulation shall be listed and labeled.

B. External duct insulation, except spray polyurethane foam, and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inches (914 mm) with the name of the manufacturer, the thermal resistance R-value at the specified installed thickness and the flame spread and smoke-developed indices of the composite materials. Duct insulation product R-values shall be based on insulation only, excluding air films, vapor retarders or other duct components, and shall be based on tested C-values at 75°F (24°C) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its R-value shall be determined as follows:

1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
2. For duct wrap, the installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.

3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
4. For spray polyurethane foam, the aged R-value per inch (mm), measured in accordance with recognized industry standards, shall be provided to the customer in writing at the time of foam application.

C. Vapor retarders.

1. Where ducts used for cooling are externally insulated, the insulation shall be covered with a vapor retarder having a maximum permeance of 0.05 perm [2.87 ng/(Pa × s × m²)] or aluminum foil having a minimum thickness of 2 mils (0.051 mm). Insulations having a permeance of 0.05 perm [2.87 ng/(Pa × s × m²)] or less shall not be required to be covered. Joints and seams shall be sealed to maintain the continuity of the vapor retarder.
   a. Exception: A vapor retarder is not required for spray polyurethane foam insulation having a water vapor permeance of not greater than 3 perms per inch [1722 ng/(s × m² × Pa)] at the installed thickness.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 1,200 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: maximum permeance of 0.05 perm (when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

C. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

D. Indoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.

4. Maximum Density: 8.0 pcf.

B. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: of 0.05 perm , when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

C. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

D. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETING AND ACCESSORIES

A. Reinforced Tape:

1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.

B. Plain Foil Tape:

1. Aluminum foil with pressure-sensitive adhesive on paper release liner.

C. UL181 Tape for Rigid and Flexible Ductwork:

1. Comply with UL 181A for rigid ductwork.
2. Comply with UL 181B for flexible ductwork.
3. Aluminum foil coated with pressure-sensitive adhesive on paper release liner.
4. Foil tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated Ducts Conveying Air Below Ambient Temperature (Supply Air):

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

D. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. Supply Ducts, Return Ducts, and Plenums:

1. Glass fiber, flexible or board. Not less than R-6 Insulation. Install with vapor barrier.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 078400 - Firestopping.

C. Section 099123 - Interior Painting: Painting insulation jacket.

D. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

F. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Pipe and duct insulation shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C). Pipe and duct insulation shall be listed and labeled. Pipe and duct insulation shall not be used to reduce the maximum flame spread and smoke-developed indices except where the pipe or duct and its related insulation, coatings, and adhesives are tested as a composite assembly in accordance with NYSMC 2025 Section 602.3.8.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. Maximum Service Temperature: 1,200 degrees F.
2. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.

1. K Value: ASTM C177, 0.23 at 75 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

C. Vapor Barrier Lap Adhesive: Compatible with insulation.

D. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETING AND ACCESSORIES

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 10 mil, 0.010 inch.
e. Connections: Brush on welding adhesive.

B. Aluminum Jacket:

1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Type: Factory-applied, self-adhesive jacketing.
4. Finish: Smooth.
5. Joining: Longitudinal slip joints and 2 inch laps.
6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

F. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

3.03 SCHEDULE

A. Heating Systems:

1. Heating Water Supply and Return:
   a. Glass Fiber: k=0.25-0.29 Btu-in/(h-ft2-dF), Mean Temperature Rating 125dF
      1) 1/2" to 1-1/4" Pipe Size: 1.5 inch thick OR Minimum R-9 Value when installed.
      2) 1-1/2" to <4" Pipe Size: 2.0 inch thick OR Minimum R-11 Value when installed.

B. Cooling Systems:

1. Chilled Water, Condensate Drains from Cooling Coils:
   a. Glass Fiber: k=0.21-0.27 Btu-in/(h-ft2-dF), Mean Temperature Rating 75dF
      1) 1/2" to 1-1/4" Pipe Size: 0.5 inch thick OR Minimum R-2 Value when installed.
      2) 1-1/2" to <4" above Pipe Size: 1.0 inch thick OR Minimum R-5 Value when installed.

C. Refrigerant piping

1. Flexible Elastomeric Insulation
2. Insulation Conductivity and Thickness to be in alignment with 2025 Energy Conservation Construction Code of New York State based on refrigerant operating temperature as designated by cold room manufacturer.

END OF SECTION 230719

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

A. Control System.

B. BAS Equipment.

C. Local Control Units.

D. Unitary Controllers.

E. Alarm Panels.

F. Analog Controllers.

G. Time Clocks.

H. Electronic Sensors.

I. Status Sensors and Devices – Electric.

J. Gas Detection Equipment.

K. Airflow Measuring Stations.

L. Duct-Mounted Airflow Station.

M. Flow Meters.

N. DDC BTU Metering.

O. Thermostats.

P. Actuators.

Q. Control Valves.

R. Dampers.

S. Control Cable.

T. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

U. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.02 REFERENCE STANDARDS

A. ASHRAE 136 - A Method of Determining Air Change Rates in Detached Dwellings; 2006.

B. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2026).

C. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

D. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.

E. CEA-709.1 - Control Network Protocol Specification; 2012.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. NEMA TP 80049 - Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas; 2025.

H. NEMA BS 31032 - Residential Controls–Electrical Wall-Mounted Room Thermostats; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.03 DEFINITIONS

A. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks licensed by Echelon Corp.

B. BACnet: A communications protocol for implementing interoperable controllers established by ASHRAE

1.04 PERFORMANCE REQUIREMENTS

1.05 SUBMITTALS

A. Action Submittals

1. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
    a. Building Automation System: Include technical data for operator workstation, operating system software, color graphics; editors for graphics, point database, and programming; software licensing, software updates during construction, and other third-party applications.

b. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for remote operator's terminal, operator display menus, interface equipment to BAS, DDC Controllers, Unitary Controllers, Application Specific Controllers (e.g. Air Terminal Controller), transducers/transmitters, sensors, control dampers, damper actuators, control valves, valve actuators, relays/switches, auxiliary control panels.

c. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

2. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   a. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   b. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
   a. Details of control panel faces, including controls, instruments, and labeling.
   b. Written description of sequence of operation.
   c. Schedule of dampers including size, leakage, and flow characteristics.
      1) Coordinate dampers sizes with sheet metal and/or mechanical contractor before submitting.
   d. Schedule of valves including flow characteristics.
   e. Schedule of Terminal Equipment Controllers; e.g. air terminals, unit ventilators, etc.
   f. DDC System Hardware:
      1) Wiring diagrams for control units with termination numbers.
      2) Schematic diagrams and floor plans for field sensors and control hardware.
      3) Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
   g. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
   h. Controlled Systems:
      1) Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
      2) Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
      3) Written description of sequence of operation including schematic diagram.
      4) Points list.
4. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE Std 135.
5. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
6. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.
7. Samples for Verification: For each color required, of each type of thermostat or sensor cover.

8. Software and Firmware Operational Documentation: Include the following:
    a. Software operating and upgrade manuals
    b. Program Software Backup: On a DVD (CD-ROM) complete with data files
    c. Device address list
    d. Printout of software application and graphic screens
    e. Software licenses required by and installed for DDC workstations and control systems
9. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
10. Qualification Data:
    a. Manufacturer's product line being submitted shall be in full production for at least two years.
    b. Installer shall be factory trained and authorized in the installation, startup, check-out and commissioning of the manufacturer's product line being submitted. Installer's field personnel shall have at least three years' experience in the installation of DDC-style temperature control systems.
11. Field quality control test reports
12. Installing contractor's commissioning reports
    a. Calibration records and list of set points.

B. Informational Submittals

C. Closeout Submittals

D. LEED Submittals

E. Operation and Maintenance Materials

1. The control system Contractor shall provide and maintain on site working spare parts for the control system during the warranty period including DDC Controllers, power supplies, modules, sensors, floor level (subnet) devices, transformers, etc. The owner will be custodian of these spare parts and shall be authorized to utilize them in performing first level maintenance. The control contractor Contractor shall refurbish/replace spare parts in exchange for failed items.
2. Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
    a. Maintenance instructions and list of spare parts for each type of control device and the compressed air station.
    b. Interconnection wiring diagrams with identified and numbered system components and devices.
    c. Keyboard illustrations and step-by-step procedures indexed for each operator function.
    d. Inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
    e. Calibration records and list of set points.

F. Record Documents

G. The control system shall be guaranteed for a period of two years after final approval by the Owner. The guarantee shall be provided for a completely installed system, including all components, parts, and assemblies of the control system. The guarantee shall cover parts, materials, and labor to locate and correct any defects in materials or workmanship.

H. The Contractor shall initiate the warranty period by formally transmitting to the Owner commencement notification of the period for the system and devices accepted. The warranty period begins when these devices are formally accepted by the Owner (refer to ACCEPTANCE PROCEDURE below).

I. Contact information shall be provided for quick service engineering assistance concerning hardware and software problems. There shall be provisions made for getting manufacturer certified diagnostic and repair personnel on the scene quickly should the need arise. There shall also be a software expert familiar with the software of this machine who can be easily contacted.

J. This system shall be inspected by the control system Contractor for a four-hour period once each quarter during the warranty period to run diagnostic tests and also provide maintenance instructions to the operating personnel.

K. The control system Contractor shall give the Owner 24 hours prior notification of each maintenance trip during the contract guarantee period. In addition, the Contractor shall furnish the Owner and Engineer a written record of each maintenance trip, number of employees present, time involved and work accomplished.

L. Owner shall be able to make changes to database, when prior database is stored on disk in case of error in change, without affecting or voiding warranty.

M. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

1. All contractor controls personnel working on the project must have documented knowledge and a minimum of 2 years of DDC experience specifically with the control systems being installed in the project.
2. The on-site installer must have demonstrated ability to control all project HVAC equipment using contractor installed, BACnet-compliant components in compliance with the project requirements.
3. The contractor shall provide qualified on-site support for front-end graphics installation and commissioning.

N. 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.

O. Comply with ASHRAE Std 135 for DDC system components.

1.06 COORDINATION

A. Coordinate location of thermostats, humidistats, DDC control sensors, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 28 Section "Intrusion Detection" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate equipment with Division 28 Section "Access Control" to achieve compatibility with equipment that interfaces with that system.

D. Coordinate equipment with Division 27 Section "Clock Systems" to achieve compatibility with equipment that interfaces with that system.

E. Coordinate equipment with Division 28 Section "PLC Electronic Detention Monitoring and Control Systems" to achieve compatibility with equipment that interfaces with that system.

F. Coordinate equipment with Division 26 Section "Network Lighting Controls" to achieve compatibility with equipment that interfaces with that system.

G. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.

H. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

I. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

J. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

K. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

L. Coordinate installation of control dampers, smoke dampers, HVAC equipment isolation dampers, and pipe-mounted sensors and instruments with the mechanical and/or plumbing contractor.

M. Coordinate installation of duct, space, outdoor, or building static pressure sensors with the finished surfaces, installing contractor and the Architect prior to installation.

N. Coordinate installation of any exterior wall or roof-mounted sensors, instruments, photocells, or controllers required for the temperature control system with the General Contractor and the Architect prior to installation.

O. Coordinate the color selection process of any sensor or device intended to be mounted on finished surfaces with the Architect prior to installation.

P. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

Q. System Software: Update to latest version of software at Project completion.

PART 2 PRODUCTS

2.01 CONTROL SYSTEM

A. BAS and DDC Manufacturers:

1. Alerton.
2. Automated Logic Corporation.

B. Control system shall consist of sensors, indicators, dampers, damper actuators, valves, valve actuators, final control elements, interface equipment, other apparatuses and accessories to control mechanical systems.

C. Control system shall consist of sensors, indicators, dampers, damper actuators, valves, valve actuators, final control elements, interface equipment, other apparatuses and accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

D. Control system shall include the following:

1. Building lighting control system specified in Division 26 Section "Network Lighting Controls"
2. Fire alarm system specified in Division 28 Section "Fire Detection and Alarm"
3. Interface to manufacturer-provided equipment controllers, specified in other Division 23 Sections.
4. Direct interface means to third-party controllers via DDC sub-LAN specified herein and/or LonTalk or BACnet interface; as required by the installing contractor for a complete and operational system.
5. Proprietary “gateway products” as shown on control drawings to provide fully functional sub-system control/point monitoring.

2.02 BAS EQUIPMENT

A. Operator Workstation: One PC-based microcomputer(s) workstation-class (not residential-class) with Operating System software with minimum configuration as follows:

B. Coordinate closely with Owner’s IT staff especially if workstation will reside on the Owner’s nwtwork.

1. Motherboard: With 4 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, BIOS, and hardware monitoring.
2. Processor: Intel Core i7; MHz.
3. Random Access Memory: 8 GB minimum GB.
4. Graphics: Video adapter 1280 x 1024 pixels, 32-bit color, 64-MB video memory, with TV out.
5. Monitor: 22 inches, 1280 x 1024 pixels, LCD color.
6. Keyboard: QWERTY, 105 keys, (in ergonomic shape – customer preference).
7. Hard-Disk Drive: 256 GB.

8. DVD/RW Read/Write Drive: 16x8x16.
9. Mouse: Two-button, center wheel, Three button optical.
10. Retain UPS requirement based on customer needs.
11. Uninterruptible Power Supply: 2 kVa.
12. Revise next sentence, if not an IT integration project, then “provide firewall and virus protection software.
13. Operating System: Microsoft Windows 7 Professional with high-speed Internet access. Coordinate firewall and virus protection software requirements with the Owner’s IT staff for integration projects. If system is not integrated over the Owner’s IT network or is using a proprietary network, provide stand-alone firewall and virus protection software.
    a. ASHRAE Std 135 Compliance: Workstation shall useASHRAE Std 135 protocol and communicate using ISO 8802-3 (Ethernet) data-link/physical layer protocol.
    b. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA-709.1 data-link/physical layer protocol.
14. Printer: Black-and-white dot-matrix or inkjet as follows:
    a. Print Head: 1200 x1200 dpi maximum resolution
    b. Paper Handling: Tractor feed for dot-matrix or a minimum of 250 sheet trays
    c. Print Speed: Minimum of 15 pages per minute
15. Printer: Color inkjet type as follows:
    a. Print Head: 4800 x 1200 dpi maximum resolution; optimized color resolution
    b. Paper Handling: Minimum of 100 sheets
    c. Print Speed: Minimum of 10 pages per minute in black/white and 5 pages per minute in color
16. BAS Application Software:
    a. I/O capability from operator station
    b. System security for each operator via software password and access levels
    c. Automatic system diagnostics; monitor system and report failures
    d. Field DDC database creation (editing) and support
    e. Automatic and manual database save and restore.
    f. Automatic and manual database transfer to field panels
    g. Dynamic color graphic displays
    h. Up to 10 screen displays at once.
    i. Custom graphics generation (editing) and graphics library of HVAC equipment and symbols.
    j. Ability to print color graphic on a color printer
    k. DDC program creation (editing) and support.
    l. Automatic and manual database save and restore.
    m. Automatic and manual database transfer to field panels
    n. Time of Day Program (Scheduling)
    o. Includes override scheduling and holiday scheduling
    p. Automatic and manual database save and restore.

q. Automatic and manual database transfer to field panels
r. Alarm processing, messages, and reactions.
s. Trend logs retrievable in spreadsheets and database programs.
t. Alarm and event processing.
u. Alarms shall “break-though” and provide audible annunciation (may be turned off)
v. Object and property status and control.
w. Automatic restart of field equipment on restoration of power.
x. Data collection, reports, and logs. Include standard reports for the following:
y. Current values of all objects.
z. Current alarm summary.
aa. Disabled objects.
bb. Alarm lockout objects.
cc. Logs.
dd. Custom report development.
ee. Utility and weather reports.
ff. Workstation application editors for controllers and schedules.
gg. Maintenance Management is very expensive. Check with Owner first.
hh. Maintenance Management.

17. Custom Application Software:
    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Support floating-point arithmetic with mathematic functions.
    f. Contains predefined time variables.
18. Configure the workstation to restart automatically after a power failure when a UPS is not provided or present.

C. Diagnostic Terminal Unit: Portable notebook-style, PC-based, microcomputer capable of accessing system data by connecting to system network with minimum configuration as follows:

1. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Core i3 , MHz.
3. Random-Access Memory: 8 GB MB.
4. Graphics: Video adapter, minimum 800 x 600 pixels, 64 MB video memory.
5. Monitor: 17 inches LCD color.
6. Keyboard: QWERTY 105 keys, (in ergonomic shape – customer preference).
7. Hard-Disk Drive: 128 GB .
8. CD-ROM Read/Write Drive: 48x24x48 .
9. Pointing Device: Touch pad or other internal device; or optical mouse if intended for desktop use.

10. Software:
    a. Provide laptop with Windows Operating System (OS) to comply with Owner's IT requirements for current and future support. Coordinate with the Owner representative.
    b. Provide all software necessary, including 3rd party, to provide Owner access to HVAC and equipment controllers (DDC controllers, Unitary Controllers, Terminal Equipment Controllers, and Application Specific Controllers).
11. Cables: Provide necessary cables (including proprietary) to connect laptop to each controller as required in the project.

D. Direct Digital Control (DDC) Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.
    d. Software applications, scheduling, and alarm processing.
    e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
4. ASHRAE Std 135 Compliance: Control units shall use ASHRAE Std 135 protocol and communicate using ISO 8802-3 (Ethernet) data-link/physical layer protocol.
5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA-709.1 data-link/physical layer protocol.
6. Enclosure:
    a. Indoor - Dustproof rated for operation at 32 to 120 degrees F.
7. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
    a. Binary Inputs: Allow monitoring of on-off signals without external power.
    b. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
    c. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4- to 20-mA), or resistance signals.
    d. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
    e. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4- to 20-mA) or resistance (0- to 135-ohms) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
    f. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.

g. Universal I/O's: Provide software selectable binary or analog outputs.

8. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
   a. Output ripple of 5.0 mV maximum peak-to-peak.
   b. Combined 1 percent line and load regulation with 100-microsecond response time for 50 percent load changes.
   c. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
9. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
   a. Minimum dielectric strength of 1000-V.
   b. Maximum response time of 10 nanoseconds.
   c. Minimum transverse-mode noise attenuation of 65-dB.
   d. Minimum common-mode noise attenuation of 150-dB at 40- to 100-Hz.

2.03 LOCAL CONTROL UNITS

A. Modular, comprising processor board with electronically programmable, non-volatile, read-only memory; and backup power source.

B. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

C. All other controller attributes match the DDC controller.

D. Stand-alone mode control functions operate regardless of network status. Functions include the following:

1. Global communications.
2. Discrete/digital, analog, and pulse I/O.
3. Monitoring, controlling, or addressing data points.

E. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

F. ASHRAE Std 135 Compliance: Control units shall useASHRAE Std 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

G. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA-709.1 datalink/physical layer protocol.

H. Enclosure:

1. Indoor - Dustproof rated for operation at 32 to 120 degrees F.

2.04 UNITARY CONTROLLERS

A. Controllers shall be provided for (but not limited to) Unit Ventilators, Fan Coils Units, Heat Pumps, etc.

B. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. I/O Interface: Hardwired inputs and outputs into system through controller
3. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock.
4. Perform automatic controller diagnostics; monitor controller and report failures.
5. ASHRAE 136.
6. LonWorks Compliance: Communicate using EIA/CEA-709.1 data-link/physical layer protocol using LonTalk protocol.
7. Enclosure:
    a. Indoor - Dustproof rated for operation at 32 to 120 degrees F.
    b. Outdoor - Weatherproof rated for operation at minus 10 to 150 degrees F.

C. Air Terminal Unit Equipment Controllers (TEC)

1. Variable Air Volume (VAV) and Constant Air Volume (CAV). CAV are indicated when minimum and maximum design cfms are scheduled the same.
2. Other equipment controllers that are similar are Series Fan-Powered and Parallel Fan-Powered VAV Terminals, and dual-duct air terminals.
3. Modular construction, comprising processor board with programmable, nonvolatile, random access memory; and integral interface equipment.
4. Units execute commands from DDC control units and download from or upload to diagnostic terminal unit.
5. Controllers shall operate in stand-alone mode and control functions operate regardless of BACnet status. Functions include the following:
    a. BACnet communications
    b. Discrete digital input/outputs and analog input/out
    c. Hardware for sensing air flow from flow measuring device
    d. Monitoring and controlling points
    e. HVAC software application programs that are application specific (e.g. VAV) and alarm processing
    f. Terminal port for program selection, addressing, air balance, and firmware updates.
6. Application Specific Programs:
    a. VAV and CAV air terminal control algorithms as needed to perform the sequences on the drawings.
    b. Series and Parallel Fan-Powered air terminal control algorithms as needed to perform the sequences on the drawings.

c. Dual-duct air terminal control algorithms as needed to perform the sequences on the drawings.

7. Units of Measure: Inch-Pound
8. Remote communications to DDC Controllers.
9. Local terminal plug for field service and air balancer use. Provide air balance subcontractor with software necessary for air balance work.
10. In a proprietary system, protocol compliance is based on the DDC manufacturer's choice. Delete next sentence if not applicable.
11. Protocol Compliance: Control units shall communicate using existing BACnet protocol.
12. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
    a. Binary Inputs: Allow monitoring of on-off signals without external power.
    b. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
    c. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4- to 20-mA), or resistance signals.
    d. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
    e. Analog Outputs: Provide modulating signal, low voltage (0- to 10-V dc) or current (4- to 20-mA); with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer or selector switch.
    f. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
    g. Universal I/O's (optional as needed): Provide software selectable binary or analog outputs.
    h. Airflow probed connections for sensing airflow through terminal.
13. Power Supply: Class 2 transformers located in DDC Auxiliary Panel shall provide 24 VAC (current-limited) with fuse protection to TEC's.
14. Power Line Filtering: Transient voltage and surge suppression for controllers.
15. Enclosure:
    a. Indoor – Dust-proof rated for operation at 32 to 120 degrees F.

2.05 ALARM PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricated 0.06 inch thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.

1. Alarm Condition: Indicating light flashes and horn sounds.
2. Acknowledge Switch: Horn is silent and indicating light is steady.
3. Second Alarm: Horn sounds and indicating light is steady.
4. Alarm Condition Cleared: System is reset and indicating light is extinguished.

5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.06 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable setpoint, scale range minus minus 10 to 70 degrees F, and single or double pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. To bring motor up to minimum speed rapidly, controller shall briefly apply full voltage when starting motor. Equip with filtered circuit to eliminate radio interference.

E. Receiver Controllers: Single- or multiple-input models with control point adjustment, direct or reverse acting with mechanical Setpoint adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.

1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 15 psig.
2. Proportional band shall extend from 2- to 20-percent for 5 psig.
3. Authority shall be 20- to 200-percent.
4. Air supply pressure of 25 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.
5. Gages: 1-1/2 inches in diameter, 2.5 percent full-scale accuracy, marked in psig (kPa), and ranged to match transmitter input or output pressure.

2.07 TIME CLOCKS

A. Manufacturers:

1. ATC-Diversified Electronics.
2. Grasslin Controls Corporation.
3. Paragon Electric Co.
4. Precision Multiple Controls.
5. SSAC Inc.
6. TCS/Basys Controls.
7. Theben AG - Lumilite Control Technology.
8. Time Mark Corporation.

B. Seven-day, programming-switch timer with synchronous timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.

C. Solid-state, programmable time control with 4 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.08 ELECTRONIC SENSORS

A. DESCRIPTION

1. Vibration and corrosion resistant, for wall, immersion, or duct mounting as required.
2. All sensors provided with a guard or cover shall submit color samples to the Architect before ordering sensors.
3. Room Sensor Cover Construction: Manufacturer's standard locking covers. This applies to all wall mounted sensors.
   a. Color: Submit color selection to Architect prior to ordering.
   b. Orientation: Vertical.
   c. Appearance: Flush.
   d. Housing: Metal.
4. Room sensor accessories include the following:
   a. Insulating Base: For sensors located on exterior walls and cold surfaces.
   b. Guard: Locking; heavy-duty transparent plastic; mounted on separate base.
   c. Adjusting Device: As required for calibration and cover screws.

B. AIR TERMINAL EQUIPMENT ROOM SENSOR

1. Manufacturers:
   a. Siemens Building Technologies.
   b. Johnson Controls.
2. Sensor:
   a. See THERMISTOR and RTD below.
3. Wiring requirement: Twisted, shielded-pair cable or pre-manufactured cables with terminations matched to the controller.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers. Include the following with those listed above.
   a. Electronic display: LCD (temperature)
   b. Setpoint Adjustment: Concealed.
   c. Setpoint Indication: Exposed.
   d. Pushbutton for override: Required.

C. THERMISTORS

1. Manufacturers:
   a. MINCO.
   b. MAMAC Systems.
   c. RDF Corporation.
2. Sensor type and accuracy:
   a. Negative temperature coefficient (NTC) sensor with 10K-ohms or less resistance.
3. Wiring requirement: Twisted, shielded-pair cable.
4. Accuracy: Plus or minus 0.5 degrees F at calibration point.
5. Wiring requirement: Twisted, shielded-pair cable.
6. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
7. Averaging Elements in Ducts: 36 inches long, flexible use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
8. Insertion Elements for Liquids: Brass well (for copper, brass, or plastic pipe) with minimum insertion length of 2-1/2 inches. Stainless steel well for ferrous pipe.
9. Outside Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
10. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. RTD AND TRANSMITTERS

1. Manufacturers:
   a. MINCO.
   b. MAMAC Systems.
   c. RDF Corporation.
2. Sensor element:
   a. Platinum.
   b. Nickel.
3. Accuracy: Plus or minus 0.5 degrees F at calibration point.
4. Wiring requirement: Twisted, shielded-pair cable.
5. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9-sq. ft. (0.84-sq. m.).
6. Averaging Elements in Ducts: 18 inches long, rigid use where prone to temperature stratification or where ducts are larger than 9 sq. ft; length as required.
7. Insertion Elements for Liquids: Brass well (for copper or brass pipe) with minimum insertion length of 2-1/2 inches. Stainless steel well for ferrous pipe.
8. Outside Air Sensors: Watertight, electrical inlet fitting; sensors are shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
10. Transmitter output shall be 4- to 20-mA, nominal 24-V dc. Output impedance must meet DDC input requirements.

E. PRESSURE TRANSMITTERS/TRANSDUCERS

1. Manufacturers:
   a. BEC Controls.
   b. General Electric. (General Eastern Instruments)
   c. MAMAC Systems.
   d. Rotronic Instrument Corp.
   e. Setra Systems.
   f. TCS/Basys Controls.
   g. Vaisala.
2. Sensors: Appropriate sensing chamber for medium being sensed.
3. Wiring requirement: twisted, shielded-pair cable for wiring unless specified otherwise by the manufacturer.
4. Air Static Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2-% full scale with repeatability of 0.5 percent.
   b. Output: 4- to 20-mA. Output impedance must meet input requirements.
   c. Building Static Pressure Range: Minus 0.05 to 0.05 inches wg.
   d. Duct Static Pressure Range: 0 to 2.5 inches wg.
5. Hydronic Pressure Transducers: Stainless steel diaphragm construction, suitable for service; minimum 150 psig operating pressure; linear output.
   a. Accuracy: 2-% FS scale reading with repeatability of 0.5-% FS
   b. Output: 4- to 20-mA, nominal 24-V dc. Output impedance must meet input requirements.
   c. Range: 0 to 60 psig.
6. Hydronic Differential Pressure Transducers: Stainless steel diaphragm construction, suitable for service; minimum 150 psig operating pressure and tested to 300 psig; linear output. Provide 3-valve manifold with instrument.
   a. Accuracy: 1-% FS overall accuracy: includes sensor accuracy, linearity, hysteresis, and non-repeatability.
   b. Output: 4- to 20-mA, nominal 24-V dc, loop- powered. Output impedance must meet DDC input requirements.
   c. Range: 0 to 60 psig.
7. Air Differential Pressure Switch: Snap acting, pilot-duty rated contact, and with suitable scale range and setting adjustment.
   a. SPDT or DPDT, dry contact style device
   b. Range: Adjustable from 1- to 10- inches wg
   c. Differential: Adjustable from 2-psig to 10-psig
8. Air Differential Pressure Switch: Snap acting, pilot-duty rated contact, and with suitable scale range and setting adjustment.
   a. SPDT or DPDT, dry contact style device
   b. Range: Adjustable from 1 to 10 inches wg.
   c. Differential: Adjustable from 0.1 to 0.25 inches wg.
9. Process Pressure and Differential Pressure Transmitters: Direct acting for gas or steam service; range suitable for system; linear output.
   a. Accuracy: 1-% FS with repeatability of 0.5-% FS.

b. Output: 4- to 20-mA, nominal 24-V dc, loop-powered. Output impedance must meet DDC input requirements.
c. Air Pressure Range: 0 to 100 psig.
d. Velocity Pressure Range: 0 to 0.5 inches wg.
e. Add vacuum pressure sensors if required in project.

2.09 STATUS SENSORS AND DEVICES - ELECTRIC

A. Status Input for Fan: Differential pressure switch with pilot-duty rated contacts and adjustable range of 0 to 5 inch wg.

1. Manufacturers:
a. Cleveland Controls.

B. Status Input for Pump: Liquid differential pressure switch with pilot-duty rated contacts and adjustable pressure range of 20 to 60 psig and differential pressure range of 5 to 30 psig, SPDT contacts pilot-duty rated or for application, ¼" female NPT pipe connections.

1. Manufacturers:
a. United Electric Controls.

C. Sensing Inputs for Electric Motors:

1. Manufacturers:
a. American Aerospace Controls.
2. Current Transformer/Transmitter: Comply with ISA 50.00.01, current-sensing, fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current and 1 percent full-scale accuracy, for AC or DC applications.
3. Voltage Transformer/Transmitter (100- to 600-V AC): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy, for AC or DC applications.
4. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor, for AC and DC applications.

D. Current Switch: Self-powered, current-sensing, split-core, solid-state devices with adjustable trip current and indicating LED, selected to match motor current and DDC input requirements.

1. Manufacturers:
a. Nielsen-Kuljian.
b. Veris Industries.

E. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

1. Manufacturer's

a. DDC equipment manufacturer's recommended product

F. Water Flow Switch: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA EN 10250, Type 1 enclosure.

1. Manufacturers:
   a. Xylem.
   b. I.T.M. Instruments.

G. Liquid Leak Detectors

1. Liquid detectors shall utilize microchip technology for detection of conductive liquids through one of the following types of sensors: gold-plated probes, self-adhesive sensor tape with copper electrodes and durable cotton cover, or rope type sensor. Detectors shall be selected based on the best use for the application. Power requirement shall be 11-27 VAC or VDC and have a green LED normal operation indicator. Unit shall have a SPDT pilot duty low voltage alarm contact. Unit shall be waterproof and rustproof. A red LED shall indicate the presence of liquid. Unit shall have an adjustable setpoint.
2. Approved Manufacturers:
   a. R. E. Technologies.
   b. Dorlen Products. (Water Alert)

H. Control Relay: Monitors or controls AC or DC motors or other equipment (as required), with cover, with visual indicator when energized, and two SPDT contacts rated 120/250 VAC at 8 Amps.

1. Manufacturers:
   a. Dayton.
   b. Omron.
   c. Functional Devices.

I. Damper End Switch (limit switch): Fully encapsulated, mercury-type, damper end switch with two contacts per switch; one for interlock wiring and one for DDC input.

1. Manufacturers:
   a. KELE Controls part number TS-470-2.

J. Emergency Power-Off (EPO) Push-button: ADA compliant, push-button switch with clear cover to prevent inadvertent closure. Push-to-activate push-button, key-to-reset feature, and providing two SPDT contacts rated 120/250 VAC at 10 Amps.

1. Manufacturers:
   a. Safety Technology International – model SS-2212PO.

K. Boiler EPO Contactor: Electrically operated, electrically held; provide contactor in NEMA-12 rated enclosure. Six (6) normally closed contacts rated 120/250 VAC at 20 Amps.

1. Manufacturers:

a. Allen-Bradley.
b. Cutler-Hammer.
c. Square-D.

2.10 GAS DETECTION EQUIPMENT

A. Carbon Dioxide Sensor:

1. Manufacturers:
   a. General Eastern. (General Electric)
   b. MSA Canada.
   c. Telaire.
   d. TSI Incorporated.
   e. Vaisala.
   f. Valtronics.
2. Sensor element:
   a. Sensor range shall be 0- to 2000-ppm.
   b. Single detector using solid-state, non-dispersive, infrared (NDIR) sensor.
   c. Suitable for operation over a temperature range of 23 to 130 degrees F for outside air; a temperature range of 32 to 104 degrees F for duct- or room-mounted.
   d. Calibrated for 4 percent of full scale accuracy, with continuous or averaged reading.
3. Accuracy: Plus or minus 50-ppm CO2 at calibration point. Accuracy includes hysteresis, repeatability, and yearly drift values.
4. Wiring requirement: Twisted, shielded-pair cable.
5. Insertion Elements in Ducts: Provide template for cutting or drilling ductwork for mounting holes.
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Setpoint Adjustment: None
   b. Display: Concealed.
   c. Color: _____.
   d. Orientation: Vertical.
7. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
8. Transmitter output: 4- to 20-mA, nominal 24-V dc; loop-powered, compatible with DDC system input impedance.

2.11 AIRFLOW MEASURING STATIONS

A. Manufacturers:

1. Ebtron. Gold Advantage II Model GT
2. Air Monitoring Corporation.

B. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans.

1. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.

C. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.

1. Each sensor assembly shall contain two individually wired, hermetically sealed, bead-in-glass thermistors.
2. Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.
3. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output.
4. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.
5. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.
6. Devices using chip-in-glass or diode-case chip thermistors are not acceptable.
7. Devices using less than two thermistors in each sensor assembly are not acceptable.
8. Devices using platinum wire RTDs are not acceptable.
9. Devices having electronic circuitry mounted in or at the sensor probe are not acceptable.
10. Pitot tubes and arrays are not acceptable.
11. Vortex shedding devices are not acceptable.

D. All Sensor Probes

1. Each sensor assembly shall independently determine the airflow rate and temperature at each measurement point.
2. Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).
3. Airflow accuracy shall be +/-2% of Reading over the entire operating airflow range.
    a. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
4. Temperature accuracy shall be +/- 0.15 degrees F over the entire operating temperature range of minus 20 to 160 degrees F.
5. The operating humidity range for each sensor probe shall be 0% RH to 99% RH (non-condensing).
6. Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
7. Each sensor assembly shall not require matching to the transmitter in the field.
8. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.

E. Duct and Plenum Probes

1. Probe shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.
2. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
   a. Insertion mounted through the side or top of the duct.
   b. Internally mounted inside the duct or plenum.
   c. Standoff mounted inside the plenum.
3. The number of sensor housings provided for each location shall be as follows:
   a. Total # of Sensors/Location
   b. 4
   c. 6
   d. 8
   e. 12
   f. 16
4. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.

F. Transmitters

1. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor assembly.
2. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.
3. The transmitter shall have a power switch and operate on 24 VAC (isolation not required).
   a. The transmitter shall use a switching power supply fused and protected from transients and power surges.
   b. The transmitter shall use “watch-dog” circuitry to assure reset after power disruption, transients and brownouts.
4. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.
5. The operating temperature range for the transmitter shall be minus 20 to 120 degrees F. The transmitter shall be installed at a location that is protected from weather and water.
6. The transmitter shall be capable of communicating with other devices using one of the following interface options:
   a. Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-V dc to 10-V dc / 4-mA to 20-mA (4-wire), output impedance compatible with DDC system input.
7. The transmitter shall be capable of accepting an infrared interface card for downloading airflow and temperature data or uploading transmitter configuration data using a handheld PDA (Palm or Microsoft Windows Mobile operating systems).
   a. Provide PDA upload/download software.
   b. Download software shall be capable of displaying and saving individual sensor airflow rates, the average airflow rates, individual sensor temperatures and the average temperature received from the transmitter.

c. Upload software shall be capable of displaying and saving all setup parameters that can be configured using the on-board pushbutton interface and LCD display.
d. Provide a Microsoft Excel file capable of creating balance reports from PDA data files transferred to a Windows 98 or higher based PC.
e. Provide a Microsoft Excel file to create configuration data files that can be transferred from a Windows 2000, Windows XP or higher based PC to a PDA for upload to one or more transmitters.

G. The ATMD shall be UL listed as an entire assembly.

H. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans.

I. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.

J. Select Ebtron Gold or Silver above or determine whether a lower cost solution like duct-mounted below can be used. Airflow stations are advisable over airflow arrays for accuracy.

2.12 DUCT-MOUNTED AIRFLOW STATION

A. Manufacturers:

1. Air Monitor Corporation.
2. Dietrich-Standard.

B. Combination of air straightener and multiport, self-averaging, Pitot-tube station and/or airflow measuring arrays.

C. Casing: Galvanized-steel frame.

D. Flow Straightener: Aluminum honeycomb, 3/4 inch parallel cell, 3 inches deep.

E. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.

2.13 FLOW METERS

A. Liquid Flow Meters: (Electro-Magnetic Type)

1. Manufacturers (Water or Glycol/Water):
   a. Siemens.

2. The meter system shall consist of a primary flow sensor and transmitter. The flow sensor shall be equipped with 150-lb. flanges. The meter system shall be installed with all necessary grounding components and gaskets per manufacturer's instructions. The meter shall be capable of bi-directional operation. The meter shall be sized appropriately for the range of flow for the system. The electrodes shall be stainless steel or Hasteloy C. The transmitter shall be provided with a remote mounting bracket, cable, integral LCD display, NEMA 4X housing, and shall indicate flow rate, totalize flow, and shall have an isolated 2-wire 4-20 mA linear output signal and a pulsed output signal for totalization. The transmitter shall be capable of being field calibrated and reprogrammed from the outside housing via magnetic probe or integral keypad menu switching. Unit electronics shall have noise immunity. The primary flow sensor and transmitter shall be mounted in accessible locations. Unit shall have the capability to maintain flow total in non-volatile memory. The flow meter shall be provided with a 1-year warranty and application non-degraded performance guarantee. The flow meter and transmitter as a unit shall have the following minimum characteristics:
   a. Flow meter Liner:
   b. Heating hot water, domestic hot water, and other water systems operating at or above 110 degrees F: Teflon
   c. Chilled water, domestic cold water, and other water systems operating below 110 degrees F: Polyurethane
   d. Accuracy:
   e. At 1- to 33-feet per second (0.3- to 10.1-m/s) velocity: plus or minus 0.5-% of rate.
   f. At 0.3-feet per second (0.1-m/s) velocity: ±2% of rate.
   g. Each unit shall be factory calibrated for the specified flow and shall be calibrated in both directions if the application is bi-directional. Calibration shall be a minimum of three point. Specific performance test data shall be furnished with the meter.
   h. Each meter shall provide two analog 4- to 20-mA signals or a single 4-to 20-mA signal and a digital contact closure on reverse flow.
   i. Meters for steam condensate shall be capable of sensing flow with condensate conductivity down to 6 µS/cm.
3. Provide a phenolic tag for each transmitter to identify service and meter ID number (i.e. SECONDARY CHILLED WATER FLOW, FM-1, etc.).

2.14 DDC BTU METERING

A. DDC BTU metering shall be accomplished using the following equipment at each metering point:

1. One (1) liquid flow meter unit with current-loop transmitter as specified elsewhere in this section.
   a. Flow meter range shall be 125% of the maximum expected flow capacity.
2. Two (2) high-precision matched temperature sensor assemblies with current-loop transmitters. Sensors with stainless steel wells shall be installed in each respective supply and return pipe as shown on project drawings for ferrous piping (use copper or brass wells for copper piping).
   a. Manufacturers: MINCO and TCS
   b. Temperature sensors shall be a matched pair selected for this application.

c. Temperature sensor accuracy shall be plus or minus 0.1-degrees F (0.05-degrees C) at calibration temperature. Calibration temperature for chilled water is 44.0-degrees F (6.7-degrees C) and for heating hot water is 180.0-degrees F (82.2-degrees C).

3. These devices shall be wired to a local DDC panel. Calculations for instantaneous and totalized load shall be incorporated into the panel control code, and the necessary virtual points shall be created to allow remote monitoring and trending via the DDC system.

B. DDC shall perform BTU computations using linear, square law, or multi-point linearization data interpretation, as needed, based on the flow meter used. Inputs shall include:

1. 4- to 20-ma signal from hydronic flow meter
2. 4- to 20-ma signal from two, high-accuracy, immersion temperature sensors

C. Input devices shall be rated for the environment in which they are installed. DDC shall perform rate of flow calculations as well as monitor the flow and totalize it weekly, monthly, and yearly. These values shall be available at the BAS in graphical format for operator monitoring. Flow rate alarms shall be programmed for low flow and high flow conditions.

D. Provide an equipment tag for each transmitter device to identify service and ID number (i.e. CHILLED WATER BTU METER – ANNEX BUILDING, etc.).

2.15 THERMOSTATS

A. Manufacturers:

1. Erie Controls.
2. Danfoss Inc.
3. Heat-Timer Corporation.
4. Sauter Controls Corporation.
5. Tekmar Control Systems.
6. Theben AG - Lumilite Control Technology.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches FAN ON-OFF
2. Mount on single electric switch box.

C. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling
2. Preferential rate control to minimize overshoot and deviation from setpoint
3. Capable of providing four separate temperatures per day
4. Instant override of setpoint for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on weekday, Saturday, and Sunday

7. Selection features include degree F or degree C display, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
    a. Time of the day
    b. Actual room temperature
    c. Programmed temperature setpoints
    d. Programmed time for occupied/unoccupied
    e. Duration of timed override
    f. Day of week
    g. System mode indications include "heating," "off," "fan auto," and "fan on."

D. Low-Voltage, On-Off Thermostats: NEMA BS 31032, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 55- to 85-degrees F (13- to 30-degrees C) setpoint range, and 2-degrees F (1-degree C) maximum differential.

E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed setpoint adjustment, 55- to 85-degrees F (13- to 30-degrees C) setpoint range, and 2-degrees F (1-degree C) maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual, On-Off-Auto.

F. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

G. Fire-Protection Thermostats: Listed and labeled by an nationally recognized testing laboratory (NRTL) acceptable to authority’s having jurisdiction; with fixed or adjustable settings to operate at not less than 75-degrees F (24-degrees C) above normal maximum operating temperature, and the following:

1. Reset: Manual only
2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.

H. Pneumatic Room Thermostats: one pipe(s), fully proportional with adjustable throttling range and tamperproof locking settings, direct or reverse acting as required.

1. Factory Calibration: 2.5-psig/degree F (31.0-kPa/degree C).
2. Range: 45- to 85-degrees F (7- to 29-degrees C).
3. Sensitivity Adjustment Range: 1- to 4-psig/degree F (12.4- to 49.6-kPa/degree C).
4. Dual-Temperature Thermostats: Automatic changeover from normal setting to lower setting for unoccupied cycles, with manual-reset lever to permit return to normal temperatures during unoccupied cycles, with automatic reset to normal during next cycle of operation.
5. Limits: Field adjustable, to limit setting cooling setpoint above 74-degrees F (23-degrees C), and heating setpoint below 72-degrees F (22-degrees C).
6. Room Thermostat Cover Construction: Manufacturer's standard locking covers.
   a. Setpoint Adjustment:
   b. Setpoint Indication: Concealed
   c. Thermometer: Concealed
   d. Color: _____.
   e. Orientation: Vertical
7. Room thermostat accessories include the following:
   a. Insulated Base: For thermostats located on exterior walls.
   b. Thermostat Guards: Locking; heavy-duty, transparent plastic; mounted on separate base
   c. Adjusting Key: As required for calibration and cover screws.
   d. Aspirating Boxes: For flush-mounted aspirating thermostats.
   e. Setpoint Adjustment: 1/2 inch diameter, adjustment knob.

I. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable setpoint.

J. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable setpoint in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

K. Electric, Low-Limit, Duct Thermostat (Freezestat): Snap-acting, single-pole, single-throw, manual-reset-only switch, that trips when the air temperature sensed across any 12 inches of capillary length is equal to or below setpoint, concealed setpoint adjustment for low and high setting, and provides 15- to 55-degrees F (minus 9- to 13-degrees C) setpoint range and fixed differential.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20-sq. ft. (2-sq. m.) of coil surface.

L. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12-inches (300-mm) of bulb length is equal to or above setpoint.

1. Bulb Length: Minimum 20 feet.

2. Quantity: One thermostat for every 20 sq. ft of coil surface.

M. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.16 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Motor characteristics such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment." If different characteristics are required, insert additional subparagraphs below to suit Project.
3. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
4. Non-spring Return motors for valves larger than NPS 2-1/2: Size for running torque of 150 in x lbf and breakaway torque of 300 in x lbf.
5. Spring-Return motors for valves larger than NPS 2-1/2: Size for running and breakaway torque of 150 in x lbf.
6. Non-spring Return motors for dampers larger than 25 sq. ft: Size for running torque of 150 in x lbf and breakaway torque of 300 in x lbf.
7. Spring-Return motors for dampers larger than 25 sq. ft: Size for running and breakaway torque of 150 in x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:
   a. Belimo Aircontrols (USA).
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft of damper cross-sectional area.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft of damper cross-sectional area.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper cross-sectional area.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft of damper cross-sectional area.
   e. Dampers with 2 to 3 inches wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.

f. Dampers with 3 to 4 inches wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual, gear release on non-spring-return actuators.
7. Manual Operation: Provided for all valve actuators.
8. Power Requirements (Two-Position Spring Return): 24-V ac.
9. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
10. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
11. Temperature Rating: Minus 22 to 122 degrees F.
12. Temperature Rating (Smoke Dampers): Minus 22 to 250 degrees F.
13. Run Time: 12 seconds open, 5 seconds closed.

2.17 CONTROL VALVES

A. Manufacturers (unless noted otherwise below):

1. Erie Controls.
2. TAC Inc. (Schneider Electric).
3. Magnatrol Valve Corporation.
4. Neles-Jamesbury.

B. Control Valves - General:

1. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Control Valve Piping –General:

1. Brass- and bronze-body valves shall be piped with copper/brass/bronze pipe using copper/brass/bronze piping fittings. When piping connects to ferrous piping connections, dielectrics must be used.
2. Steel- and iron-body control valves shall be piped with ferrous piping using ferrous pipe fittings. When piping connects to non-ferrous piping connections, dielectrics must be used.

D. Standard valves are also available for Class 250, 250 psig and up to 350 degrees F operating conditions. Coordinate with mechanical system engineer.

E. Hydronic Globe Control Valves shall have the following characteristics:

1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, screwed ends, with back-seating capacity, and repackable under pressure.

2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless steel or brass seats.
    a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 3 psig maximum pressure drop at design flow rate or the following:
    a. Two-Position: Line size or one size smaller.
    b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

F. Steam Globe Control Valves shall have the following characteristics:

1. NPS 2 and Smaller: ASME/ANSI Class 250 bronze body, stainless steel trim, rising stem, renewable composition disc, screwed ends, with back-seating capacity, and repackable under pressure.
2. NPS 2-1/2 and Larger: ASME/ANSI Class 250 iron body, stainless steel trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless steel seats.
    a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
    b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
    c. Steam valve sizing varies from maker to maker and should be coordinated with the vendor selected in submittal stage.
4. Sizing: For pressure drop based on the following services:
    a. Two-Position (isolation): Between 1-psig (7kPa) and no more than 20 percent of inlet pressure.
    b. Two-position (on/off control of load): See modulating control.
    c. Modulating 15-psig (103-kPa) Steam: Up to 80 percent of inlet steam pressure and meeting the coil manufacturer’s design requirements.
    d. Modulating 16- to 50-psig (110- to 350-kPa) Steam: No more than 50 percent of inlet steam pressure.
    e. Modulating More Than 50-psig (350-kPa) Steam : As indicated on drawings or schedules.
5. Flow Characteristics: Modified linear characteristics.

6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of operating (inlet) pressure.

G. Butterfly Control Valves shall have the following characteristics:

1. Manufacturers:
   a. DeZurik.
   b. Keystone.
   c. Centerline (Crane).
2. Rating: 150-psig (1034-kPa) maximum pressure differential, ASTM A126 cast-iron or ASTM A536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
3. Butterfly valves are acceptable for piping or equipment isolation use. For modulating service, do not allow the valve to go over 60% open under control to the load.
4. Body Style: Wafer
5. Disc Type: Nickel-plated ductile iron
6. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate or the following:
   a. Two-Position (isolation): 1-psig (7-kPa) or less at design flow rate.
   b. Two-Way Modulating: Either the value specified above or twice the load water pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load water pressure drop, but not more than value specified above.

H. Terminal Unit Control Valves shall have the following characteristics:

1. Rating: NPS 2 (DN 50) and smaller, bronze body, bronze trim, rising stem, two or three ports as indicated, renewable composition disc, sweat and threaded ends, with back-seating capacity, and repackable under pressure.
2. Class 125 for service at 125-psig (860-kPa) and 250-degrees F (121-degrees C) operating conditions.
3. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate for hydronic valves and able to close against pump shutoff head.
4. Flow Characteristics:
   a. Hydronic Valves: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
   b. Steam Valves: Two-way valves shall have linear characteristics.

I. Self-Contained Control Valves shall have the following characteristics:

1. Type: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and available in union and threaded ends.
2. Rating: Class 125 for service at 125-psig (860-kPa) and 250-degrees F (121-degrees C) operating conditions.
3. Thermostatic Operator: Wax-filled integral sensor with integral adjustable dial.
4. Coordinate the following two sections with above requirements and Owner preference/acceptance.

J. Pressure-Independent Characterized Control Valves (PICCV) shall have the following characteristics:

1. Manufacturers:
   a. Belimo.
2. NPS 1-1/4 (DN 32) and Smaller: Pressure rated at 400-psig (2758-kPa) body; 200-psig (1379-kPa) close-off pressure.
3. Internal Construction: Internal construction: chrome plated brass ball and stem (stainless steel stem also acceptable), characterizing disc shall be brass or Tefzel and replaceable, diaphragm for small valves shall be Nomex or silicone, for larger valves polyester-reinforced silicone. End fittings shall be threaded (female NPT).
4. Service: Chilled or heating hot water and glycol (up to 60% solution).
5. Rating: Class 125 for service at 125-psig (860-kPa) and 250-degrees F (121-degrees C) operating conditions.
6. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.
7. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
8. Provide spring-return actuators where noted on drawings or in schedules.

K. Characterized Ball Valves shall have the following characteristics:

1. Manufacturers:
   a. Johnson Controls.
   b. Siemens Building Technologies.
   c. Honeywell International.
2. Service: Chilled water or heating hot water and glycol solutions (up to 60%). Full port ball valves shall be used only for pipe isolation service. Modulating service valves shall be characterized port valves.
3. Internal construction: chrome or stainless steel-plated brass ball with stainless steel stem and trim, characterizing disc shall be plastic and replaceable.
4. Rating: Class 125 for service at 125-psig (860-kPa) and 250-degrees F (121-degrees C) operating conditions.
5. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate; close off pressure no less than 130 psig (896-kPa).
6. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
7. Provide spring-return actuators where noted on drawings or in schedules.

L. Dental Compressed Air and Dental Vacuum Shutoff Valve

1. Manufacturers:
   a. Gas Control Equipment.
   b. Marr Valve Co.
   c. U.S. Valve.

2. Sizing: Line size all valves based on information from drawings. Coordinate with plumbing contractor during construction for changes.
3. Rating: Class 125 for service at 250 degrees F operating conditions
4. Characteristics: Two-way, 90-degree full travel, valves shall have be nickel or chrome plated brass or copper ball valves, (or fully stainless steel constructed), solenoid actuated, specifically designed for the Dental Compressed Air and Vacuum service industry. Valves shall be capable of being flushed through with solvents and cleaners prior to service.

2.18 DAMPERS

A. Manufacturers:

1. American Warming and Ventilating.
2. Mestek.
3. TAMCO.
4. United Enertech Corp.

B. Dampers: AMCA-rated, parallel blade per the design requirements; 0.108-inch- (2.7-mm-) minimum thickness, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8-inches (200-mm) and length of 48-inches (1220-mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated, sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40- to 200-degrees F (minus 40- to 93-degrees C).
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene or silicone.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals.
5. Jamb Seals: spring-loaded, stainless steel, only.
6. Leakage ratings or dampers shall be less than 10 cfm per sq. ft. (4.6 L/s per sq. m.) of damper area, at differential pressure of 4-inches wg (1000-Pa) when damper is held by torque of 50 in. x lbf. (5.6 N x m.); when tested according to AMCA 500D.

2.19 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

PART 3 EXECUTION

3.01 APPLICATION

3.02 EXAMINATION

A. Verify that a commercial power supply is available to control units and operator workstation.

B. Verify that emergency power supply is available to control units and operator workstation if required for project.

C. Verify that the UPS is rated for the controller power needs and has been provided.

D. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed properly before proceeding with wiring installation.

3.03 INSTALLATION

A. Install software and/or custom programming in DDC control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Install DDC controller panels in locations noted on plans or coordinate with Architect. Coordinate with Electrical Contractor for power.

D. Install DDC temperature control instruments and devices on all controlled equipment per control plans and provide supply air and control branch air piping as required for a complete installation.

E. DDC control system wiring in conduit, J-hooks, or installed in bridle rings (when allowed) shall:

1. Run conduit runs along building and steel sight-lines (not diagonal or where support is improper).
2. Support all conduit with independent hangers, not from ductwork/piping or from ductwork/piping hangers/trays/supports/Unistrut; and independent of other trade’s work.
3. Anchor J-hooks to walls or suspend J-hooks using 1/4-inch minimum diameter threaded rod hangers. Do not support J-hooks from ceiling or equipment hangers. J-hooks shall not impede removal of accessible ceiling tiles.

F. Control wiring and pneumatic tubing in conduit or installed exposed (when allowed) shall:

1. Run conduit runs along building and steel sight lines (not diagonal or where support is not proper).
2. Support all conduit with independent hangars, not from ductwork/piping or from ductwork/piping hangars/trays/supports and independent of other trade’s work.
3. Anchor J-hooks to walls or suspend J-hooks using 1/4-inch minimum diameter threaded rod hangers. Do not support J-hooks from ceiling or equipment hangers. J-hooks shall not impede removal of accessible ceiling tiles.
4. Pneumatic tubing in mechanical equipment rooms shall always be installed in conduit or installed as copper tubing.

5. Pneumatic tubing installed in plenum air spaces (exposed or concealed) and in duct/piping shafts shall be plenum-rated by Underwriters' Laboratories Inc.

G. Mount compressor and tank unit on.elastomeric mounts Vibration isolators are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Isolate air supply with wire-braid-reinforced rubber hose. Secure and anchor according to manufacturer's written instructions and seismic-control requirements.

1. Pipe manual and automatic drains to nearest floor drain.
2. Supply instrument air from compressor units through dryer, filter, pressure reducing valve, and pressure relief valve, with pressure gages at inlet and outlet connections, and shutoff and bypass valves at the air dryer and filter/PRV combination.

H. Install temperature control panels in locations noted on plans or coordinate with Architect. Coordinate with Electrical Contractor for power.

I. Install temperature control instruments and devices on all controlled equipment per control plans and provide supply air and control branch air piping as required for a complete installation.

J. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Installation height of devices.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

K. Install guards on thermostats in the following locations:

1. Building Entrances
2. Public areas and restrooms
3. Where indicated on drawings

L. Furnish automatic dampers according to Division 23 Section "Air Duct Accessories" to installing contractor for installation.

M. Install damper motors on outside of ductwork in warm areas, not in locations exposed to outdoor temperatures.

N. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

O. Furnish hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping" " to installing contractor for installation.

P. Install hydronic, gas, compressed air, and/or steam flow meters and accessories according to this specification and per locations shown on the plans.

Q. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.04 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Route conduit and plenum cables along building and steel lines (not diagonal) and do not hang conduit or bridle rings from ductwork and piping or their support means

D. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

E. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

F. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Pressure test control air piping at 30-psig (207-kPa) or 1.5 times the operating pressure for 24 hours, with maximum 5-psig (35-kPa) loss.
5. Pressure test high-pressure control air piping at 150-psig (1034-kPa) and low-pressure control air piping at 30-psig (207-kPa) for 2 hours, with maximum 1-psig (7-kPa) loss.

6. Test calibration of pneumatic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
7. Test each point through its full operating range to verify that safety and operating control setpoints are as required.
8. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
9. Test each system for compliance with sequence of operation.
10. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check that insertion instruments are located in the correct section of piping.
5. Check instrument piping for proper fittings, slope, material, and support.
6. Check instrument tubing for proper fittings, material, and support.
7. Check installation of air supply for each instrument.
8. Check water flow instruments. Inspect tag number and line and bore size, verify that upstream/downstream dimensions are per manufacturer's requirements, and that instruments are installed correctly.
9. Check airflow instruments. Inspect tag number and ductwork size, verify that upstream/downstream dimensions are per manufacturer's requirements, and that instruments are installed correctly.
10. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
11. Check temperature instruments, material, and length of sensing elements.
12. Check control dampers/valves. Verify that proper blade alignment, either parallel or opposed, has been provided. Verify that valves are installed in the correct direction.
13. Delete subparagraph below is all electric DDC controls.
14. Check air-operated dampers/valves. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided. Verify that valves are installed in the correct direction. Verify that pilot positioners, end switches, and/or feedback devices if provided, are installed and calibrated properly.
15. Check electric-operated dampers/valves and hydraulic-operated valves. Verify that proper blade alignment, either parallel or opposed, has been provided. Verify that valves are installed in the correct direction. Verify end switches and/or feedback devices are installed properly.
16. Check DDC system as follows:
    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.06 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate installed devices and instruments, whether electric or pneumatic.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milli-ampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature, CO, CO2, static pressure, humidity, etc., set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.07 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative of the manufacturer (or manufacturers authorized and trained installation representative) to demonstrate the system's operational status in all modes of control. This shall be arranged for the following:

B. Modify this section to include unique arrangements and Owner's needs. This may vary significantly.

1. Every control drawing Mxxx: Demonstrate system in all modes of operation per Sequence of Operation stated.
2. Where there are multiple devices (VAV box, unit heater, cabinet unit heater, fan coil unit, etc.) installed identically, perform demonstration on 25% of the installed quantity, in all modes of operation per Sequence of Operation stated.

C. Refer to Division 01 Section "Demonstration and Training."

3.08 GRAPHIC DISPLAY GENERATION

A. Provide the following graphic displays as a minimum at the operator workstations, arranged in logical penetration paths:

1. Overall campus layout which shows all of the buildings on the Owner's campus.
2. Individual building layout or isometric for each building connected to the system.
3. Floor plans for each floor within each building, with display of present values of space conditions sensed by connected space sensors, display of the name of the air handler associated with each space sensor, display of the room number in which the sensor is located and color coding to indicate whether the sensed space condition is within the acceptable range, is too high, or is too low. TC Contractor shall confirm Owner desired room names prior to graphics generation which may differ from the room names indicated on construction documents.
4. Schematic diagram for each HVAC system. Each system schematic display shall include at least the following:
    a. Schematic arrangement of ductwork, fans, dampers, coils, valves, piping, pumps, equipment etc.
    b. System name.
    c. Area served.
    d. Present value or status of all inputs, along with present setpoint.
    e. Present percent open for each damper, valve, etc. based on commanded position.
    f. Reset schedule parameters for all points, where applicable.
    g. Present occupancy mode.
    h. Present economizer mode, where applicable.
    i. Present outside air temperature.
    j. Associated space conditions and setpoints, where applicable.
    k. Status of application programs (e.g., warm-up, night cycle, duty cycle, etc.).
    l. Color coding to indicate normal and abnormal values, alarms, etc.

5. Manual override capability for each on/off or open/closed controlled digital output (for fans, pumps, 2-position dampers and valves, etc.) and each modulating analog output (for dampers, valves, VFD speed modulation type points, etc) shall be provided. Graphic display of output point auto or manual override status shall be provided.
6. Sequence of operation in written (text) format for each HVAC system.
7. Overall BAS system schematic.
8. System management graphic for each network device and/or DDC panel.
9. Provide a separate page for critical alarm summary.

B. Contractor to provide graphics that are fully operational prior to commissioning.

3.09 SYSTEMS INTEGRATION

A. The following items have been provided and are prepared for Demonstration and Owner Training:

1. New DDC Controllers are interfaced to the existing EMS network.
2. New DDC Controllers are fully and readily accessible from existing graphical user workstations.
   a. Graphics “links” are provided from top most level graphic to sub-graphic (if existing) and then to the newly installed systems.
   b. New systems are readily identifiable with links to the equipment controller graphic or another sub-graphic.
   c. Back buttons (“links”) take users back one level and provide a link out to the top-most graphic.
3. All DDC/EMS communication wiring (cable) is coordinated and provided, and fully tested with the Owner’s IT staff.
4. EMS software upgrades or updates and networking software upgrades or updates have been provided, when required.
5. Networking (building level) controllers requiring upgrades or updates have been provided, when required.

3.10 OWNER TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel on how to operate, maintain, and adjust HVAC instrumentation and controls.

1. Training shall be provided for a period of 40 hours in 4-hour increments; to be scheduled with the Owner’s representative at least 2-weeks in advance.
2. Provide all training materials needed for a complete training session including but not limited to Operation and Maintenance Manuals, product catalogs, and “record drawings” of the controls installation.
3. Training shall be a combination of classroom (printed material and electronic presentations) and mechanical room (hands-on) instruction.

B. Refer to Division 01 Section "Demonstration and Training."

3.11 ACCEPTANCE PROCEDURE

A. SUBMITTALS data relevant to point index, functions limits, sequences, interlocks, power fail/restarts, logs, software routines and associated parameters, and other pertinent information for the operating system and database shall be forwarded from the control system contractor to the Owner.

B. Approved database will be entered into the central computer, debugged, and down line loaded to Controllers. Prior to on-line operation, a complete demonstration and readout of the computer command shall be performed in the presence of the Owner. In addition, a printout of the database generated for all points, shall be reviewed with the Owner by the control system contractor. Modification to the database shall be made by the control system contractor as directed by the Owner.

C. All points shall be verified prior to "punch-out" for correct and accurate correspondence between the CRT data display and actual field location and equipment operation.

D. Upon successful completion of system generation the Owner shall be requested in writing to inspect and approve the satisfactory operation of the control system, sub-systems, and accessories.

END OF SECTION 230900

SECTION 230923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. System software.

F. Controller software.

1.02 RELATED REQUIREMENTS

A. Section 230913 - Instrumentation and Control Devices for HVAC.

B. Section 230993 - Sequence of Operations for HVAC Controls.

C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h, with Editorial Revision (2022).

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
4. Indicate description and sequence of operation of operating, user, and application software.

D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.

E. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Automated Logic Corporation

B. Alerton

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 CONTROLLERS

A. Building Controllers:

1. General:
    a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
    b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
    c. Share data between networked controllers.
    d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
    e. Utilize real-time clock for scheduling.
    f. Continuously check processor status and memory circuits for abnormal operation.
    g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
    h. Communication with other network devices to be based on assigned protocol.
2. Communication:
    a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.

b. Perform routing when connected to a network of custom application and application specific controllers.
c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. External Input-Output (I-O) Data Bus:
4. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
5. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
6. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
7. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:

1. General:
   a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   b. Share data between networked, microprocessor based controllers.
   c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   d. Utilize real-time clock for scheduling.
   e. Continuously check processor status and memory circuits for abnormal operation.
   f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   g. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
   b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:

a. Outdoors and/or in Wet Ambient Conditions:
   1) Mount within waterproof enclosures.
   2) Rated for operation at 40 to 150 degrees F.
b. Conditioned Space:
   1) Mount within dustproof enclosures.
   2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
   a. Diagnostic LED's for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:

1. General:
   a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
   b. Customized for operation within the confines of equipment served.
   c. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
   b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:

a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

D. Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:

c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.04 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:
   a. Dielectric strength of 1000 volts minimum.
   b. Response time of 10 nanoseconds or less.
   c. Transverse mode noise attenuation of 65 dB or greater.
   d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.05 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.06 SYSTEM SOFTWARE

A. Operating System:

1. Concurrent, multi-tasking capability.
   a. Common Software Applications Supported: Microsoft Excel.
   b. Acceptable Operating Systems: _____.
2. System Graphics:
   a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
   b. Animation displayed by shifting image files based on object status.
   c. Provide method for operator with password to perform the following:
      1) Move between, change size, and change location of graphic displays.
      2) Modify on-line.
      3) Add, delete, or change dynamic objects consisting of:
         (a) Analog and binary values.
         (b) Dynamic text.
         (c) Static text.
         (d) Animation files.
3. Custom Graphics Generation Package:
   a. Create, modify, and save graphic files and visio format graphics in PCX formats.
   b. HTML graphics to support web browser compatible formats.
   c. Capture or convert graphics from AutoCAD.

B. Workstation System Applications:

1. Automatic System Database Save and Restore Functions:
   a. Current database copy of each Building Controller is automatically stored on hard disk.
   b. Automatic update occurs upon change in any system panel.
   c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
2. Manual System Database Save and Restore Functions by Operator with Password Clearance:

a. Save database from any system panel.
b. Clear a panel database.
c. Initiate a download of a specified database to any system panel.

3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
4. On-line Help:
   a. Context-sensitive system assists operator in operation and editing.
   b. Available for all applications.
   c. Relevant screen data provided for particular screen display.
   d. Additional help available via hypertext.
5. Security:
   a. Operator log-on requires user name and password to view, edit, add, or delete data.
   b. System security selectable for each operator.
   c. System supervisor sets passwords and security levels for all other operators.
   d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
   e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
   f. All system security data stored in encrypted format.
6. System Diagnostics:
   a. Operations Automatically Monitored:
      1) Workstations.
      2) Printers.
      3) Modems.
      4) Network connections.
      5) Building management panels.
      6) Controllers.
   b. Device failure is annunciated to the operator.
7. Alarm Processing:
   a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
   b. Configurable Objects:
      1) Alarm limits.
      2) Alarm limit differentials.
      3) States.
      4) Reactions for each object.
8. Alarm Messages:
   a. Descriptor: English language.
   b. Recognizable Features:
      1) Source.
      2) Location.
      3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:

a. Logging.
b. Printing.
c. Starting programs.
d. Displaying messages.
e. Dialing out to remote locations.
f. Paging.
g. Providing audible annunciation.
h. Displaying specific system graphics.

10. Custom Trend Logs:
    a. Definable for any data object in the system including interval, start time, and stop time.
    b. Trend Data:
        1) Sampled and stored on the building controller panel.
        2) Archivable on hard disk.
        3) Retrievable for use in reports, spreadsheets and standard database programs.
        4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
        5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
    a. View all system alarms and change of states from any system location.
    b. Events listed chronologically.
    c. Operator with proper security acknowledges and clears alarms.
    d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
    a. Provide a method to view, edit if applicable, the status of any object and property in the system.
    b. Status Available by the Following Methods:
        1) Menu.
        2) Graphics.
        3) Custom Programs.
13. Reports and Logs:
    a. Reporting Package:
        1) Allows operator to select, modify, or create reports.
        2) Definable as to data content, format, interval, and date.
        3) Archivable to hard disk.
    b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
    c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
    d. Set to be printed on operator command or specific time(s).
14. Reports:
    a. Standard:

1) Objects with current values.
2) Current alarms not locked out.
3) Disabled and overridden objects, points and SNVTs.
4) Objects in manual or automatic alarm lockout.
5) Objects in alarm lockout currently in alarm.
6) Logs:
   (a) Alarm History.
   (b) System messages.
   (c) System events.
   (d) Trends.

b. Custom:
1) Daily.
2) Weekly.
3) Monthly.
4) Annual.
5) Time and date stamped.
6) Title.
7) Facility name.

c. Tenant Override:
1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
2) Annual report showing override usage on a monthly basis.

d. Electrical, Fuel, and Weather:
1) Electrical Meter(s):
   (a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
   (b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
2) Fuel Meter(s):
   (a) Monthly showing daily natural gas consumption for each meter.
   (b) Annual summary showing monthly consumption for each meter.
3) Weather:
   (a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

C. Workstation Applications Editors:

1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
   a. Configuration.
   b. Name.
   c. Control parameters.

d. Set-points.

4. Scheduling:
   a. Monthly calendar indicates schedules, holidays, and exceptions.
   b. Allows several related objects to be scheduled and copied to other objects or dates.
   c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:
   a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
   b. Programming Features:
      1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
      2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
      3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
      4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
      5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
      6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
      7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
      8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.
      9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.07 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:

1. User access secured via user passwords and user names.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
3. User Log On/Log Off attempts are recorded.
4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:

1. Weekly Schedules Based on Separate, Daily Schedules:
   a. Include start, stop, optimal stop, and night economizer.
   b. 10 events maximum per schedule.
   c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:

1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
   a. Operator determines action to be taken for alarm event.
   b. Alarms to be routed to appropriate workstation.
   c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 230993.

H. PID Control Characteristics:

1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:

1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. Energy Calculations:

1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:

1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:

1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:

1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

C. Provide basic operator training for ____ persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

3.05 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

C. Provide complete service of systems, including call backs. Make minimum of ____ complete normal inspections of approximately ____ hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION 230923

SECTION 232113 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Heating water and glycol piping, above grade.

D. Chilled water piping, above grade.

E. Equipment drains and overflows.

F. Pipe hangers and supports.

G. Unions, flanges and mechanical couplings connections.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels.

C. Section 099123 - Interior Painting.

D. Section 230516 - Expansion Fittings and Loops for HVAC Piping.

E. Section 230523 - General-Duty Valves for HVAC Piping.

F. Section 230548 - Vibration and Seismic Controls for HVAC.

G. Section 230553 - Identification for HVAC Piping and Equipment.

H. Section 230719 - HVAC Piping Insulation.

I. Section 232114 - Hydronic Specialties.

J. Section 232500 - HVAC Water Treatment: Pipe cleaning.

K. Section 253516 - Integrated Automation Sensors and Transmitters: Pipe-mounted product furnishing.

L. Section 253519 - Integrated Automation Control Valves: Product furnishing.

M. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).

B. ASME B31.9 - Building Services Piping; 2020.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalog information.
3. Indicate valve data and ratings.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections or flanges whenever jointing dissimilar metals.
3. Dielectric unions are not allowed.
4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.
2. Isolate equipment using butterfly valves with lug end flanges or ball valves.
3. For bypass services, use ball or butterfly valves.
4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

2.02 HEATING WATER PIPING, ABOVE GRADE

Pipe Size	Pipe	Fittings	Joint
2.5-inch & below	ASTM B75; ASTM B88; ASTM B135; ASTM B251 Type L Hard Copper	ASME B16.22 Wrought Copper	ASTM B32 Solder 95 Sn / 5 Sb 95.5 Sn / 4 Cu / 0.5 Ag
3-inch & above	ASTM A53; ASTM A106 Sch 40 Black Steel	ASME B16.9 Wrought Steel	ASME B16.9 Butt Weld

2.03 PRIMARY AND SECONDARY CHILLED WATER PIPING, ABOVE GRADE

Pipe Size	Pipe	Fittings	Joint
2.5-inch & below	ASTM B75; ASTM B88; ASTM B135; ASTM B251 Type L Hard Copper	ASME B16.22 Wrought Copper	ASTM B32 Solder 95 Sn / 5 Sb 95.5 Sn / 4 Cu / 0.5 Ag
3-inch & above	ASTM A53; ASTM A106 Sch 40 Black Steel	ASME B16.9 Wrought Steel	ASME B16.9 Butt Weld

2.04 EQUIPMENT CHILLED WATER PIPING, ABOVE GRADE

Pipe Size	Pipe	Fittings	Joint
All Sizes	ASTM B75; ASTM B88; ASTM B135;	ASME B16.22 Wrought Copper	ASTM B32 Solder

	ASTM B251 Type L Hard Copper		95 Sn / 5 Sb 95.5 Sn / 4 Cu / 0.5 Ag

2.05 EQUIPMENT DRAINS AND OVERFLOWS

Pipe Size	Pipe	Fittings	Joint
2.5-inch & below	ASTM A53; ASTM A106 Type K Hard Copper	ASME B16.22 Wrought Copper	ASTM B32 Solder 95 Sn / 5 Sb 95.5 Sn / 4 Cu / 0.5 Ag

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2.07 FLANGES AND DIELECTRIC CONNECTIONS

A. Flanges for Pipe 2 Inches and Greater:solder

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch thick, preformed neoprene.

B. Dielectric Connections:

1. Flanges:
   a. Dielectric flanges with same pressure ratings as standard flanges.
   b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   c. Dry insulation barrier able to withstand 600-volt breakdown test.
   d. Construct of galvanized steel with threaded end connections to match connecting piping.
   e. Suitable for the required operating pressures and temperatures.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

J. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. See Section 099123.

K. Soldered joints shall be made in accordance with ASTM B828. Cut tube ends shall be reamed to the full inside diameter of the tube end. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32.

L. Threaded joints:Threads shall conform to ASME B1.20.1. Schedule 80 or heavier plastic pipe shall be threaded with dies specifically designed for plastic pipe. Thread lubricant, pipe-joint compound or tape shall be applied on the male threads only and shall be approved for application on the piping material.

M. Wedled joints: Joint surfaces shall be cleaned by an approved procedure. Joints shall be welded with an approved filler metal.

END OF SECTION 232113

SECTION 232114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Pressure-temperature test plugs.

D. Balancing valves.

E. Automatic flow control valves.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

C. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Maximum Fluid Pressure: 150 psi.

C. Maximum Fluid Temperature: 250 degrees F.

2.02 STRAINERS

A. Size 2 inch and Under:

1. Provide threaded brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
2. NO COMBINATION Y-STRAINER/BALL ISOLATION VALVES ARE PERMITTED.

B. Size 2-1/2 inch to 4 inch:

1. Provide flanged iron body for up to 175 psi working pressure, up to 250 degrees F working temperature, Y-pattern strainer with 1/16 inch or 3/64 inch stainless steel perforated screen.
2. NO COMBINATION Y-STRAINER/BALL ISOLATION VALVES ARE PERMITTED.

2.03 PRESSURE-TEMPERATURE TEST PLUGS

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

B. Application: Use extended length plugs to clear insulated piping.

2.04 BALANCING VALVES

A. Balancing valves SHALL NOT be used for coil isolation - provide ball or butterfly isolation valves in addition to balancing valves.

B. Manual balancing/control/ball isolation valve combination devices and pre-piped coil fit-out kit assemblies are not permitted.

C. Size 2 inch and Smaller:

1. Provide ball or globe style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and female sweat, NPT threaded, press, or soldered connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon or EPDM.

D. Size 2-1/2 inch and Larger:

1. Provide ball, globe, or butterfly style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and flanged or weld-end connections.
2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, or EPDM.

2.05 AUTOMATIC FLOW CONTROL VALVES

A. Not allowed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. Provide valved drain and hose connection on strainer blowdown connection.

D. The following piping specialties are not allowed due to Cornell's experience with increased frequency of maintenance:

1. Dielectric Unions
2. Automatic Flow Control Valves
3. Combination devices and pre-piped manufacturer coil fit-out kits, including but not limited to the following:
   a. Manual balance/control/ball isolation valves
   b. Y-strainer/ball isolation valves
   c. Balancing/shutoff valves
   d. Ball isolation/drain valves.
4. Triple Duty Valves

END OF SECTION 232114

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Ducts for laboratory and industrial-grade applications.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 099113 - Exterior Painting: Weld priming, weather resistant, paint or coating.

C. Section 099123 - Interior Painting: Weld priming, paint or coating.

D. Section 230548 - Vibration and Seismic Controls for HVAC.

E. Section 230713 - Duct Insulation: External insulation.

F. Section 233300 - Air Duct Accessories.

G. Section 233600 - Air Terminal Units.

H. Section 233700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. ANSI Z9.5 - Laboratory Ventilation; 2022.

B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASHRAE Std 90.1 I-P-2019 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2019, with Errata and Addenda (2021).

D. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2020.

E. ASME AG-1 - Code on Nuclear Air and Gas Treatment; 2023.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

H. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2019.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

J. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

K. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2026.

L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

M. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

N. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK). See Leakage Testing Section of this Specification for additional information.

E. Duct Leak Sealing Submittals

1. Sealant Product Data: For each product. Include manufacturer's written instructions for site preparation and installation. Include sample Seal Report or Envelope Sealing Report with pressurization test results, product data sheet, and safety data sheet.
2. Sealing Test Results: Submit Seal Report or Envelope Sealing Report with pre-and post-seal leakage (pressurization test) results.
3. Phasing: Submit phasing plan if work is to be done in phases or stages, indicating areas of work and any required work related to phasing.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Duct Leak Sealing

1. Application Temperature: Above 40 degrees F (5 degrees C). If installing below 40 degrees F (5 degrees C), consult manufacturer for recommendations.
   a. Protect substrates from environmental conditions that affect sealant performance.
   b. Do not apply to damp or wet substrates.
2. Coordination: Coordinate air leak sealing requirements with progress of related and adjacent work in progress.
3. Deliver materials in original, undamaged packages. Store in a clean, dry, protected location with temperatures from 40 to 100 degrees F. Protect from freezing.
4. Provide manufacturer's standard limited warranty.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Metallic ducts shall be constructed as specified in the SMACNA 006: HVAC Duct Construction Standards - Metal and Flexible.

B. Ducts shall be supported in accordance with SMACNA 006: HVAC Duct Construction Standards - Metal and Flexible. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's instructions.

C. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

D. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

E. Duct Shape and Material in accordance with Allowed Static Pressure Range.

F. Duct Sealing and Leakage Specific Duct System Requirements

1. HVAC supply air:
   a. Galvanized steel 6-inch wg; Class “A” between AHU and air control valve.
   b. Galvanized steel 6-inch wg; Class “A” between air control valve and reheat coil.
   c. Galvanized steel 4-inch wg; Class “A” between reheat coil and space
2. General Laboratory Exhaust:
   a. Galvanized steel negative 3-inch wg; Class “A” between room terminal and air control valve.

b. Galvanized steel negative 4-inch wg; Class"A" between air control valve and exhaust fan.

3. Fume Hood Exhaust
   a. Type 316 welded stainless steel shall be used on all horizontal branch ducts from the fume hood connection to the point where the duct connects to a main or riser.
4. Biosafety Cabinet Exhaust
   a. Class 1, round, galvanized steel.

G. **All ductwork and plenums shall be constructed to SMACNA "Seal Class A"**; which means all transverse joints, longitudinal seams and duct wall penetrations shall be sealed, regardless of specified pressure class. THIS IS A CODE REQUREMENT.

H. Longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA 006: HVAC Duct Construction Standards—Metal and Flexible and NAIMA Fibrous Glass Duct Construction Standards. Joints, longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Tapes and mastics used to seal fibrous glass ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181 A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Tapes and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181 B-C." Closure systems used to seal all ductwork shall be installed in accordance with the manufacturer's instructions.

I. Exception: For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snaplock and button-lock type joints and seams located outside of conditioned spaces.

J. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal.
4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.02 DUCT SEALING SYSTEM

A. Provide aerosol-applied, waterborne acrylic sealant for sealing duct from interior.

B. Basis of design: AeroBarrier X1 by Aeroseal. Alternates that meet or exceed specified requirements may be submitted for Engineer and Owner review and approval.

C. Aerosol-Applied, Waterborne Acrylic Sealant: Stable, non-toxic, sealant installed by an air sealing system utilizing a computerized process to pressurize an interior space, inject aerosolized sealant as a mist into the interior, and use the higher pressure air escaping to the outside through leaks in the exterior envelope to carry sealant to and through the leaks, sealing them as it passes through. Particles shall deposit at leak sites and build to form a complete and tight seal. Seals shall remain firmly in place for years while staying completely pliable and flexible.

D. Sealing: Seals leaks from the size of a human hair up to 1/2 inch (13 mm).

E. Adhesion: Sealant shall not stick to vertical surfaces such as walls, windows, or doors.

F. Certification: UL GreenGuard Gold certified. Safe to use in any type of building.

G. Ultra-Low VOC: 12 grams per liter. No off gassing.

H. Solids: 18.5 to 21.5 percent.

I. Sealant Base: Acrylic.

J. Color: White.

K. Dispersion: Water.

L. Application: Aerosol.

M. Performance Requirements: Sealant shall enhance the primary air barrier capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits. Sealant to have a 50 year endurance rating based on 50 cycles at extreme temperatures for times specified in test. Test fixture is also specific to the test to mimic real world conditions.

N. Product has been tested to the following industry standards:

1. UL GreenGuard Gold Certification.
2. ASTM C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (adapted for aerosolized sealants).

O. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.

P. UL 723 Test for Surface Burning Characteristics of Building Materials.

Q. S102 Test for Surface Burning Characteristics of Building Materials and Assemblies.

R. UL 263 Standard for Safety of Fire Tests of Building Construction Materials.

S. S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials.

2.03 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
2. Stainless Steel: ASTM A666, Type 304.

2.04 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.

1. Insulation: R6 insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 in-wc positive and 5 in-wc negative.
3. Maximum Velocity: 5500 fpm.
4. Temperature Range: Minus 20 degrees F to 250 degrees F.

2.05 DUCTS FOR LABORATORY AND INDUSTRIAL-GRADE APPLICATIONS

A. Laboratory Exhaust Applications:

1. Duct materials shall be compatible with vapors to be exhausted, and in conformance with Applicable Codes.
2. Galvanized duct is acceptable for use on laboratory general exhaust ducts and risers.
3. Bio-Safety Cabinet Exhaust:
    a. Class 1, round galvanized steel ductwork.
    b. Coordinate duct, fittings, hangers, and appurtenances to cabinet unit.
4. Fume Hood Cabinet Exhaust:
    a. Type 316 welded stainless steel shall be used on all horizontal branch ducts from the fume hood connection to the point where the duct connects to a main or riser.
    b. Minimum 20-gauge, 0.035-inch Type 316 stainless steel, unless noted otherwise.
        1) Fabricate in accordance with ductwork manufacturer's instructions; test duct system to sustain positive and negative pressures in accordance with ASHRAE Std 126 and ASME AG-1.
    c. ADA hoods designed to be adjustable by space occupants shall connect to the stainless steel duct serving the fume hood via the use of flexible stainless-steel duct or flexible hose meeting UL 94V0 for flame retardance.
    d. Provide ductwork and appurtenances in accordance with NFPA 91 requirements except where NFPA 45 applications take precedence.
    e. Coordinate duct, fittings, hangers, and accessories to comply with ANSI Z9.5.
    f. Design, fabricate, and install liquidtight preventing exhaust leakage into the building.
    g. Operating Range: 10 in-wc.

h. Seal joints during installation with factory-supplied flanges and airtight gasketing.
i. Provide with factory installed and pressure tested access doors.

PART 3 EXECUTION

3.01 PRECONSTRUCTION DUCT LEAKAGE TESTING

A. Perform duct leakage testing of the entire supply ductwork system associated with AHU-9 and AHU-9A in alignment with Specification 233100 - HVAC Ducts and Casings Section 3.03, and submit testing results to Owner and Engineer for review. If duct leakage falls below Testing Acceptance Criteria listed in said specification, perform duct sealing to reduce leakage to acceptable range.

3.02 EXISTING DUCTWORK LEAKAGE SEALING

A. EXAMINATION

1. Examine substrates, areas, and conditions, with manufacturer’s licensed Installer, for conditions affecting performance of the Work.
2. Verify substrates are free of contaminants and moisture.
3. Proceed after unsatisfactory conditions have been corrected.

B. SURFACE PREPARATION

1. Prepare internal area by covering any openings that are not intended to be sealed.
2. This includes taping or covering any designed or intentional openings and any finished horizontal surfaces within the space.
3. Set up Manufacturer’s supplied and approved Application Equipment: Includes modified blower door with frame, fan, lay flat tubing, Sealing Stations, hoses, Main Control Unit and laptop computer.

C. INSTALLATION

1. Install materials using equipment supplied by the manufacturer, in accordance with manufacturer's recommendations and approved submittals including the following:
   a. Manually seal leaks greater than ½” in size.
   b. Ambient interior temperature of the space being sealed must be at 40 degrees F (5 degrees C). If installing with an interior ambient temperature below 40 degrees F (5° C) contact the manufacturer.
   c. Pressurize: Apply positive pressure to the interior using a modified blower door.
   d. Fan shall be calibrated to meet ASTM Standard E779, E1554, CGSB-149.10 M86, EN 13829, ATTMA Technical Standard 1, NFPA 2001, RESNET and USACE
2. Application: Inject the sealant into the interior using Sealing Stations. Measure nd control the process by computer including temperature, pressure, humidity, and distribution of sealant within the interior space during the process. Continue the application process until desired level of air tightness required is achieved.

3. Sealing and Monitoring: Control application air leakage rates and monitor in real time with air leakage results reported every 60 seconds. Results displayed shall be based on a pressurization test.

D. FIELD QUALITY CONTROL

1. Air Seal Test: At the end of the application process; conduct a post seal test for each building space sealed to verify the sealing results. Installer and manufacturer shall provide a Seal Report or Envelope Sealing Report for each building space sealed that shows pre and post seal leakage.
   a. All penetrations have been sealed to the level reported in the post seal test.

E. CLEANING AND PROTECTION

1. Protect materials and installed sealant from damage during application and remainder of construction period, according to manufacturer's written instructions.
2. Clean any excess sealant from surrounding building materials as needed and remove and dispose of all protective tapes or coverings used in seal preparation.

3.03 DUCT INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts with adhesive.

G. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

H. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.

K. Use double nuts and lock washers on threaded rod supports.

L. Connect terminal units to supply ducts directly.

M. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

N. Fire Partitions: Provide firestopping sealing. See Section 078400.

O. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 233300, 233600, and 233700.

P. Duct Insulation: Provide duct insulation. See Section 230713.

Q. Painting: Provide surface finish as indicated on drawings. See Sections 099113 and 099123.

3.04 CLEANING AND PROTECTION

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers, and dehumidifiers, filters and filter sections and condensate collectors and drains.
4. Coils and related components.
5. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

F. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

1. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, or duct accessories.

2. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

G. Cleanliness Verification:

1. Visually inspect metal duct for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.05 LEAKAGE TESTING

A. Systems designed to operate below 3-inches w.c.: 25% percent of the duct system shall be leak tested. The Consultant/Owner shall randomly choose the sections of ductwork to be tested during the Construction Phase. If any of the original sections fail the leakage test, another 25% of the duct shall be chosen to be tested. If any section of the second 25% fails, the entire system shall be leakage tested.

B. Systems designed to operate equal to or in excess of 3-inches w.c.: The entire system shall be leak testedin accordance with the SMACNA HVAC Air Duct Leakage Test Manual and shown to have a rate of air leakage (CL) less than or equal to 4.0 as determined in accordance with the below equation.

C. CL = F / P^0.65

1. where:
   a. F = The measured leakage rate in cfm per 100 square feet (9.3 m²) of duct surface.
   b. P = The static pressure of the test.

D. Testing shall be performed in accordance with the SMACNA Air Duct Leakage Test Manual.

E. Leakage testing shall be witnessed by representatives from Cornell University and the Project Engineer of Record.

F. Testing Acceptance Criteria:

1. Maximum system leakage:
   a. Interior supply, return, and general exhaust systems: 5% system leakage, tested at 1.25 times the expected operating static pressure
   b. Interior Laboratory exhaust systems: 2% system leakage, tested at 1.25 times the expected operating static pressure.

END OF SECTION 233100

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Combination fire and smoke dampers.

C. Duct access doors.

D. Duct test holes.

E. Flexible duct connectors.

F. Smoke and fire-smoke damper test module.

G. Volume control dampers.

H. Miscellaneous Products:

1. Damper operators.
2. Damper position switch.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 230548 - Vibration and Seismic Controls for HVAC.

C. Section 233100 - HVAC Ducts and Casings.

D. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.

E. Section 253513 - Integrated Automation Actuators and Operators: Damper operators.

F. Section 253516 - Integrated Automation Sensors and Transmitters: Damper position switch.

G. Section 253523 - Integrated Automation Control Dampers: Product furnishing.

H. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

E. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for combination fire and smoke dampers.

E. Project Record Drawings: Record actual locations of access doors and test holes.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.
2. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

B. Provide factory sleeve and collar for each damper.

C. These assemblies shall be UL listed, with integral UL-approved sleeve, 120 VAC actuator mounted on the outside. Jackshaft penetrations shall be provided with a factory shaft seal. Sleeve seams shall be continuously welded or sealed, and the transverse joint should be a sealed UL-approved flanged duct sleeve connection.

D. Provide with damper test switch, remote annunciation indicator, contact for BACS monitoring.

E. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

F. Operators: UL listed and labeled; spring-return, electric-type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

H. Damper test switch, Remote annunciation indicator,contact for BACS monitoring.

I. Smoke detector: Refer to fire alarm specifiction section.

2.03 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.05 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

C. Maximum Installed Length: 14 inch.

2.06 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Splitter Dampers:

1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

C. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch.
2. Blade: 24 gauge, 0.0239 inch, minimum.

D. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.

1. Blade: 18 gauge, 0.0478 inch, minimum.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

F. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch size access door for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

    1. See Section 230548.

H. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

J. Use splitter dampers only where indicated.

K. Provide balancing dampers on high velocity systems where indicated. See Section 233600.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.

1. Variable-volume units.

B. Air volume control valves.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 230913 - Instrumentation and Control Devices for HVAC: Thermostats and actuators.

C. Section 230923 - Direct-Digital Control System for HVAC.

D. Section 232113 - Hydronic Piping: Connections to heating coils.

E. Section 232114 - Hydronic Specialties: Connections to heating coils.

F. Section 233100 - HVAC Ducts and Casings.

G. Section 233300 - Air Duct Accessories.

H. Section 233700 - Air Outlets and Inlets.

I. Section 251400 - Integrated Automation Local Control Units: HVAC controllers.

J. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

C. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

J. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:

1. Krueger-HVAC
2. Price Industries, Inc
3. Trane
4. Or Engineer Approved Equal

B. Basis of Design: Price Industries, Inc

1. Single-Duct Terminal Unit: SDV, (direct digital controls).

C. General:

1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
3. Provide insulated Variable Volume Units for supply air applications.

D. Unit Casing:

1. Minimum 22 gauge, 0.0299 inch galvanized steel.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
   a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071.
      1) Secure with adhesive.
      2) Coat edges exposed to airstream with NFPA 90A approved sealant.
      3) Cover liner with non-porous foil.
   b. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
   c. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

E. Damper Assembly:

1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.

2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

F. Hot Water Heating Coil:

1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
   a. Access Door: Gasketed and insulated located on bottom, on top, and downstream of coils.
   b. Right or left coil inlets.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig.
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

G. Electrical Requirements:

1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

H. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

I. Controls:

1. DDC (Direct-Digital Controls):
   a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
   b. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFMs.
      1) Occupied and unoccupied operating mode.
      2) Remote reset of temperature or CFM set points.
      3) Proportional, plus integral control of room temperature.
      4) Monitoring and adjusting with portable terminal.
   c. Room Sensor:
      1) Compatible with temperature controls specified.
      2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
   d. See Section 25 1400.

2.02 AIR VOLUME CONTROL VALVES

A. Manufacturers:

1. Accutrol LLC

2. Or engineer approved equal

B. Basis of Design: Accutrol

1. Laboratory supply air control valves: AVC6000, Insulated
2. Laboratory general exhaust air control valves: AVC6000
3. Biosafety Cabinet exhaust air control valves: AVC6000
4. Fume Hood exhaust air control valves: AVC6000

C. General:

1. Factory-assembled air volume control valves rated in accordance with AHRI 880 (I-P).
2. Clearly label each unit indicating maximum/minimum cfm, tag/mark number, model number, and manufacturer's order number.

D. Construction:

1. Casing: Minimum 20 gauge, 0.0375 inch Type 316L stainless steel suitable for welding in place without distortion, meeting the requirements of NFPA 90A and UL 181.
2. Damper: Minimum 22 gauge, 0.0299 inch Type 316L stainless steel with teflon damper shaft bearings and damper gasket.
3. Air volume control assemblies to consist of galvanized steel damper, steel, cylindrical flow diverter valve, or sliding gate valve.
4. Tight Shut-off required.
5. Supply valves to be provided with factory installed Insulation.

E. Electrical Requirements:

1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

F. Controls:

1. Provide with BAS Connection in alignment with project Controls Drawings and Specification 230900 "Instrumentation and Controls for HVAC."
2. Actuators shall be Fail Open/Close, High Speed - see schedule for required failure positions.
3. Provide with Wireless Bluetooth Configuration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 233100.

3.03 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

END OF SECTION 233600

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General Grilles, Registers and Diffusers

1. Rectangular ceiling diffusers
2. Perforated face ceiling diffusers
3. Slot ceiling diffusers.
4. Perforated face ceiling exhaust grilles.
5. Duct-mounted exhaust grilles.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

D. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. Product Data:

1. Indicate materials of construction, finish, mounting details; performance data including throw and drop, static-pressure drop, and noise ratings.
2. Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

PART 2 PRODUCTS

2.01 GENERAL GRILLES, REGISTERS AND DIFFUSERS

A. Refer to Project Drawings for locations, dimensions, materials, performance requirements, and finish requirements.

B. Manufacturers

1. Krueger
2. Price Industries
3. Titus
4. Engineer approved equal that meets or exceeds specified and scheduled requirements.

C. General Requirements

1. Frame: As required to support mounting style indicated on drawings.
2. Color: White, unless indicated otherwise on drawings.
3. Accessories: Safety chain when available. Additional accessories as indicated on drawings.

D. Rectangular Ceiling Supply Diffusers

1. Type: rectangular and square formed adjustable, backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern.
2. Frame: As required to support mounting style indicated on drawings.

E. Perforated Face Ceiling Supply Diffusers

1. Type: Perforated face with fully adjustable pattern and removable face.
2. Fabrication: Stainless steel.

F. Slot Ceil Diffusers

1. Type: Continuous 1/2 inch wide slot, three slots wide, with adjustable vanes for left, right, or vertical discharge[<>].
2. Provide with linear slot plenum for integration with linear slot diffuser.

G. Perforated Face Ceiling Exhaust Grilles

1. Type: Perforated exhaust grille.
2. Material: Steel.
3. Coordinate inlet size with required exhaust duct connections.

H. Duct-Mounted Exhaust Grilles

1. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
2. Frame: 1-1/4 inch margin with countersunk screw mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Install in accordance with manufacturer's instructions.
2. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
3. Install diffusers to ductwork with air tight connection.
4. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

3.02 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION 233700

SECTION 237313 – EXISTING CUSTOM AIR HANDLING UNIT REFURBISHMENT

PART 1 - GENERAL

1.1 EQUIPMENT AND SERVICES TO BE PROVIDED BY VENDOR

A. AHU Component Upgrades

The Vendor shall furnish, supervise installation and startup, and test the following existing custom air handling unit refurbishment, all rated and guaranteed in accordance with this Specification and as shown on the accompanying Drawings.

B. Vendor shall complete a mandatory site visit prior to release of final AHU submittal to confirm the approach and logistics.

C. Component Upgrade Scope of Work:

a. Prebalancing, preleakage testing, and refurbishment plans and materials shall be submitted to owner and engineer for review and approval prior to start of any work. System shutdowns and temporary service plans shall be coordinated with owner.
b. Pre-balance of existing systems - see specifications for additional information.
c. Perform preconstruction leakage testing of supply air ductwork of ahu-9 and ahu-9a per specifications. If leakage rate is above specified, perform duct sealing as specified to achieve leakage rate.
d. Clean and paint structural base rails supporting the equipment.
e. Refurbish air handler interior:
    i. Remove coatings and debris. Clean and dry air handler.
    ii. Remove loose corrosion. Reinforce corroded steel and patch holes. Restore interior structure, seal and protect steel.
    iii. Apply epoxy, shape and pitch to ensure appropriate sloping to drain.
    iv. Apply fire barrier for NFPA 90A compliance per manufacturer's instructions.
    v. Water-proof polymeric antimicrobial topcoat (Aquis or similar). Install per manufacturer's instructions.
f. Coil cleaning – steam preheat coil and chilled water cooling coil plus coil tube interiors – mechanical cleaning plus enzyme-containing biosurfactants coil restoration process (Aquis or similar).
g. Replace AHU filters.
h. Replace condensate traps and prime.
i. Remove air handler humidifier. Remove steam system traps, strainers, manual valves, control valves. Patch pipe entry and exit points to air handler.
j. Repair or replace chilled water system strainers, manual valves, control valves.
k. Replace fan belts and sheaves.
l. Check VFD for proper operation – clean housing and tighten connections as needed. Repair or replace as required.

m. Clean and tighten electrical connections.
n. Clean fan blades and fan housing, repair if needed.
o. Check integrity of panels on equipment – repair or replace as needed.
p. Lubricate all field-serviceable bearings.
q. Check damper condition, setting and operation – lubricate, repair or replace as needed.
r. Temporary system balance to enable continuous air supply to aquatics wing during ahu restoration and construction.
s. Re-balance system following startup to align with new system requirements.
t. Modify ahu controls as required to accommodate needs of new and existing areas served. See controls drawings for additional information.

D. Services to be provided by the Vendor shall consist in general of the following:

1. Site visit to confirm approach and logistics.

2. Preparation of detailed installation drawings.

3. Preparation of shop drawings for equipment and products required.

4. Refurbishment, testing, and replacement of components as described in this specification and contract drawings.

5. Startup and testing of fans, coils, dampers, etc.

6. Perform performance field tests of equipment as specified herein.

7. Installation specifications for all components.

8. Rigging and installation of all equipment and erection on at the site.

1.2 CODES AND STANDARDS

A. Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards, including, but not limited to the ones listed below:

American Society of Mechanical Engineers	ASME
American National Standards Institute	ANSI
American Society for Testing and Materials	ASTM
American Welding Society	AWS
Institute of Electrical and Electronics Engineers	IEEE
National Electrical Manufacturers Association	NEMA
American Gear Manufacturers Association	AGMA
Occupational Safety and Health Administration	OSHA
American Society for Nondestructive Testing	ASNT
Steel Structures Painting Council	SSPC
National Fire Protection Association	NFPA

Instrument Society of America	ISA
American Institute of Steel Construction	AISC
Insulated Cable Engineers Association	ICEA
Air Moving and Conditioning Association	AMCA
Manufacturers Standardization Society	MSS
Air Conditioning and Refrigeration Institute	ARI
National Electrical Code	NEC
American Society of Heating, Refrigeration and Air Conditioning Engineers	ASHRAE
Scientific Apparatus Makers' Association	SAMA
Underwriters Laboratories Inc.	UL
Environmental Protection Agency	EPA

B. Reference Standards

1. General

a. The codes, regulations and publications listed below govern the fabrication, workmanship, materials, performance capabilities and safety of the equipment to be furnished. They form a part of this Specification and they shall be the latest version, including all addenda, supplements and interpretations.

2. National Electrical Manufacturers Association (NEMA)

a. ICS1: General Standards for Industrial Control and Systems
b. ICS 2: Industrial Control Devices, Controllers and Assemblies
c. ICS 3: Industrial Systems.
d. ICS 6: Enclosures for Industrial Controls and Systems.

3. Codes: Codes as listed in Contract Documents.

4. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standards.

a. Guideline 5-1994: Preparation of Operating and Maintenance Documentation for Building Systems.

5. American Society for Testing and Materials (ASTM).

6. Comply with NFPA 90A.

7. Comply with ASHRAE 62.1.

1.3 WARRANTY

A. The contractor warrants to the customer that all products manufactured and installed by the air handling unit restoration vendor and sold to the customer, will conform to all applicable written specifications and shall be free from defects in

material or workmanship for a period of thirty-six (36) months from the date that the installation is completed and signed off.

B. General

1. Drawings and Specifications determine general arrangement and locations of equipment and piping layout and the work of the various systems. Existing equipment, ductwork, and piping arrangements shall be maintained.

C. Transportation

1. Transportation shall be from manufacturer's facility to job site.

2. All loose parts shall be sealed to prevent exposure to the elements during the shipment or storage of equipment.

3. All electrical devices and accessories shall be hermetically sealed to prevent damage due to the elements.

4. Manufacturer shall inspect upon arrival at the job site the condition of the equipment and provide a written order of acceptance of the condition of the machinery delivered.

5. If any damage has occurred during the shipment of the equipment, the manufacturer shall repair said damage at the job site at no additional cost to the Owner. The manufacturer shall provide all labor, materials, tools, recertification, etc. as required to accomplish any and all repairs.

D. Fees

1. The Contractor shall include in his Bid the cost of all required permits, fees, controlled inspections, tests and certificates of approval.

E. Quality, Workmanship, Materials and Safety

1. All work shall be first class in every respect and shall be neatly performed in a practical and workpersonlike manner by sufficient mechanics skilled in the work they are to do using the best practices of their trade, and under continuous, competent supervision.

F. Lubrication

1. Vendor furnished equipment and/or installed equipment shall be properly lubricated when connected and before operation of the equipment is begun.

2. The Vendor will be held responsible for any damage to equipment that is operated without having been properly lubricated.

1.4 QUALITY ASSURANCE

A. All equipment or components of this specification section shall meet or exceed the requirements and quality of the items herein specified or as denoted on the drawings and schedule.

B. Equipment furnished under this specification shall be in accordance with the following industry, association and government codes and standards, as applicable to their design, fabrication, assembly and testing.

1.	AMCA 99	Standards
2.	AHRI 430	Central Station Air Handling Units
3.	NFPA 70	National Electric Code
4.	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating System.
5.	ASHRAE 90.1	Energy Standard for Buildings Except Low-Rise Residence Buildings

C. Equipment within unit shall be UL listed where applicable.

D. All components utilized in the assembly of unit and exposed to ambient conditions and airstream shall be of suitable materials as indicated in this specification and as treated so as to prevent the formation of rust.

1.5 SUBMITTALS

A. Technical Bid Proposal

1. The Bidder shall submit with their Proposal Form digital copies of a Technical Bid Submission describing the refurbishment procedure and equipment they intend to provide and indicating its compliance with the Specifications contained herein.

2. The Technical Bid Submission shall be contained via digital copy and shall contain the following information as a minimum:

   a. Product data, including SDS Sheets for:
      a. Engineered Coating
      b. Coil Restoration Agent
      c. Tube Restoration Unit
   b. Proposed testing and refurbishment schedule, including coordinated phasing of the refurbishment of each air handler in sequence such that service to the aquatics vivarium served by the system is maintained throughout construction period.
   c. Preliminary unit drawings for the air handling unit upgrades illustrating unit layout dimensions, interior components (i.e., fans, filters, dampers, coils, doors, etc.), and component weights.

d. Unit wall, floor, and roof construction details.
e. Descriptive catalog information for all unit components specified in the Schedules.
f. Performance data for each unit (i.e., fan air flow volumes, unit pressure drops, heating and cooling capacities, etc.).
g. Fan curves.
h. Coil performance data.
i. Form of guarantee.
j. Description of on-site refurbishment, cleaning, repair, startup, and test procedures.
k. Field services to be provided during unit startup and testing and unit commissioning.

3. The Technical Bid Submission shall demonstrate that the Bidder's proposed equipment and field services are in conformance with the Specifications.

B. Shop Drawings

1. Within ten days after the award of the Contract, unless otherwise specified, submit a complete list of the manufacturer's materials and equipment to be incorporated in the work. Intention of using specified materials and equipment does not relieve obligations of submittal.

2. Shop drawings submitted shall have been reviewed and approved by the Contractor, and shall include manufacturer's names and catalog numbers, descriptive data, cuts, diagrams, drawings and such other information as may be required by the Owner to judge compliance with the requirements of the Contract Documents and suitability to the applications. Items submitted shall be well organized and clearly identified as to proposed application.

3. The Owner's review of such Drawings or schedules shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has in writing called the Owner's attention to such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.

4. Shop drawings furnished shall indicate all changes to meet refurbishment requirements, space requirements, code requirements and as necessary to resolve all space conflicts.

5. Any materials or equipment submitted for review which are not in accordance with the Specification requirements shall be rejected and resubmitted until approved without change in construction schedule and without additional cost to Owner.

6. Obtain all acceptances before ordering or installing any materials and equipment. Contractor shall be liable for its removal and replacement at no charge if, in opinion of Owner, material or equipment does not meet intent of the Contract Documents.

7. Submit digital PDF copies of manufacturer's submittal sheets or catalog cuts.

    a. Highlight all applicable material and data.
    b. Non-applicable material and data shall be struck prior to submittal.

8. Submit via file transfer site files and files of all shop drawing submittal data, including AutoCAD drawings, technical data and written specifications. Documents shall be in PDF format and drawings in DWG format.

9. Submit shop drawings of the following:

    a. Equipment drawings showing dimensions, weights (shipping and operating), configuration, major component locations, access door locations, duct connection sizes and locations, and shipping split locations.

    b. Record information collected from Owner and augmented by site visit to verify existing conditions, as follows:

        a. Fan manufacturer and performance curves with the operating points clearly indicated. Motor sizes and types.

        b. Coil selections with sizes, rows, fin spacing, face velocities, temperatures, flow rates, pressure drops, and connection sizes.

        c. Filters indicating size, efficiency, pressure drop, and type of holding frame.

        d. Materials of construction for housing and major components.

        e. Details of panel, floor, and roof construction.

        f. Damper locations, positions, and dimensions.

        g. Adjustable frequency drives.

        h. Control and power wiring diagrams of the control panel which will house the two (2) adjustable frequency drives.

PART 2 – MATERIALS

2.1 ENGINEERED COATING

A. Three layer coating system: epoxy, fire barrier, anti-microbial topcoat

    a. Surface burning characteristics (ASTM E84 per NFPA 90A):

b. Flame spread index: 25 without continued progressive combustion

c. Smoke developed index: 30

d. Surface adhesion

i. Pull off strength (ASTM D4541): 855 PSI

e. Crosshatch test (ASTM D3359): 5B (no failure)

f. Volatile emissions: zero volatile organic compounds (VOCs)

g. Odors: no detectable order during or after installation

h. Cure time: 4 hours or less until unit may be restarted

i. Active antimicrobial: EPA approved for HVAC use

j. Color: white or gray

B. Multi-acrylic, corrosion resistant, anitmicrobial coating

2.2 COIL RESTORATION AGENT

C. Probiotic, FDA GRAS listed.

D. Volatile emissions: zero volatile organic compounds (VOCs) non-corrosive

2.3 TUBE RESTORATION AGENT

3 Foamed probiotic, FDA generally recognized as safe listed.

4 Volatile emissions: zero volatile organic compounds (VOCs) non-corrosive

2.4 AIR HANDLING UNIT COMPONENTS

5 Air handling unit components shall be of the configuration, capacity and style as indicated on the drawings and equipment schedule and as existing is installed in building. Through properly designed access, ease of maintenance, removability of components, and unit serviceability shall be maintained. Where discrepancies between installed conditions and drawings exist, consult Engineer if scope clarification is required.

6 Where performance analysis, testing, and refurbishment efforts reveal disfunctioning, broken, or damaged components, components shall be replaced in kind and in accordance with Cornell Design and Construction Standards.

7 The unit components shall be constructed for indoor installation.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate refurbishment schedule with Owner. Schedule will require close coordination with building occupants of spaces intended to be occupied during refurbishment scope. Unit shut down, including fire alarm devices, shall be scheduled in accordance with Owner defined requirements.

B. Coordinate phasing of work as outlined in Division 01.

3.2 PREPARATION

A. Isolate air handling unit by sealing off adjacent ductwork from within the Air handling unit.

B. Clean and prepare all surfaces that will be addressed by refurbishment.

C. Remove non-compliant coatings and foams.

D. Reinforce compromised surfaces with steel as needed to restore Structure inside unit casing.

E. Protect lights during restoration work.

F. At each long side rail, within 1'-6" of floor drain, contractor shall drill two (2) 1/2" dia. weep holes 1" to 2" from the base of the rail. Determine exact placement in field. Review method for drilling with engineer of record to minimize risk of damage to the air handler units.

G. Prior to AHU refurbishment services, inspect and operate coil control valves, isolation valves and drain valves. Identify failed or corroded valves for replacement. Replace valves in accordance with Contract Specifications and Cornell Design and Construction Standards as applicable.

3.3 BASE SUPPORT RAILS RESTORATION

A. Clean and paint support rails at base of unit. Where back of channel is visible, paint entire height of back. Where channel flanges are visible, paint bottom flange and full height of web.

B. Where steel rails have visible corrosion, recoat as follows:

C. Mechanically clean steel support rails to remove all existing coatings, corrosion, dirt, oil, grease, organic materials, and other foreign materials. Prepare surface per Manufacturer's instructions for the new primer and paint.

D. Engage Owner for site review after surface has been cleaned.
E. Steel shall be primed with a direct to metal primer compatible with the paint selection.
F. Base bid: steel shall be painted with two coats of paint that is an alkyd enamel, acrylic urethane, alkyd urethane, waterborne acrylic, acrylic latex enamel, or approved equal with rust inhibiting properties.
G. Alternate #1: all steel shall be painted with a two-part solvent-based epoxy.
H. Topcoat shall be tinted to match existing.
I. Contractor shall submit the following for review and approval by the engineer:
    a. Primer product data
    b. Paint product data
    c. Tint color sample
    d. Basis of design is Benjamin Moore Super Spec product line.
    e. Additional approved manufacturers are Tnemec, PPG Paints, Carboline, or equal approved by Engineer of Record.

3.4 APPLICATION OF ENGINEERED COATING FOR AHU RESTORATION

A. Perform listed work in accordance with coating manufacturer requirements.
B. Apply epoxy at 3/16” nominal thickness throughout all chamber floors and Condensate pans, and 6” up walls. Slope to nearest drain.
C. Fire barrier: apply completely over epoxy.
D. Anti-microbial topcoat: apply over entirety of fire barrier to ensure Watertight surface and provide an active microbial surface.
E. Multi-acrylic, corrosion resistant, anti-microbial coating: apply to walls, Ceiling, fan housing & structural steel. Slope epoxy to drain.

3.5 COIL RESTORATION FOR THE REMOVAL OF BIOFILM AND DEBRIS

A. Perform pre-work measurements
    a. Measure total airflow
    b. Perform coil pressure testing
    c. Perform ATP testing
B. Apply coil restoration agent
C. Sanitize coils with superheated water
D. Repeat coil restoration agent and sanitation on coil faces until all Obstructions are removed across the entire coil face.
E. Apply coil restoration agent to provide residual bio-film block efficacy Once coil

restoration is completed.

F. Perform post-work measurements:
   a. Measure airflow
   b. Perform coil pressure testing
   c. Perform ATP testing

3.6 TUBE RESTORATION

A. Close shutoff valves upstream and downstream of the coil.
B. Connect supply and discharge hoses to upstream and downstream coil Connections.
C. Push eco-friendly foamed probiotic through cooling coil (max pressure 50 Psi) until foamed probiotic emerges white.
D. Allow foamed probiotic to dwell within coils for up to 4 hours.
E. Again, push foamed probiotic through cooling coil (max pressure 50 psi) Until foamed probiotic emerges white.
F. Flush coils with potable water.
G. Fill coils with fluid to match system fluid (confirm with Owner).
H. Notify Owner for permission to begin circulating water in the building chilled water and heating hot water systems.
I. Upon approval from Owner, open isolation valves.
J. Conduct coil performance analysis for water coils:
   a. Install sensors and meters to measure and collect ten (10) different data points for a minimum of one (1) hour, pre and post restoration process.
   b. Provide a detailed analysis report including improvement in coil capacity, estimated yearly energy savings, and financial summaries.

3.7 COMPONENT REPLACEMENT SCOPE

A. Replace identified failed or corroded valves in accordance with Contract Specifications and Cornell Design and Construction Standards as applicable.
B. Replace AHU filters to match existing
C. Replace condensate traps and prime. Match required trap seal depth for section pressurization.
D. Replace fan belts and sheaves to match existing.
E. Check VFD for proper operation clean housing and tighten connections as needed. Repair or replace as required.
F. Clean and tighten electrical connections.

G. Clean fan blades and fan housing, repair if needed.
H. Check integrity of panels on equipment – repair or replace as needed.
I. Lubricate all field-serviceable bearings.
J. Check damper condition, setting and operation – lubricate, repair or replace as needed.

3.8 FUNCTIONAL TESTING / FIELD QUALITY CONTROL

A. The entire electrical system shall be functionally checked, including motors, lights, utility outlets, etc. for proper operation.
B.
C. The casing leakage test shall verify that unit casing leakage is below the specified allowable leakage. The unit shall be sealed; pressure sections shall be put under positive pressure and suction sections shall be put under negative pressure. The leakage shall be measured in each section on the positive and negative side of the unit using a calibrated orifice plate. The total casing leakage (positive plus negative) shall be considered the sum of the positive and negative leakage.

D. Coil Leak Test: After installation, fill coils with water, and test coils and connections for leaks.

E. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

F. Following refurbishment work, Mechanical contractor shall make all final piping and ductwork connections required for a complete operating system. Sealing of sections at all components will be required. Welding certifications shall be submitted for welders performing field welding.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
H. Air-handling unit or components will be considered defective if unit or components do

not pass tests and inspections.

I. Prepare test and inspection reports.

3.9 START UP SERVICE

A. Engage a service representative to perform startup service.
B. Complete installation and startup checks according to original air handler manufacturer's written instructions.
C. Verify that shipping, blocking, and bracing are removed.
D. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
E. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
F. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
G. Verify that zone dampers fully open and close for each zone.
H. Verify that outdoor air dampers open and close, and maintain minimum outdoor-air setting.
I. Comb coil fins for parallel orientation.
J. Install new, clean filters.
K. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
L. Starting procedures for air-handling units include the following:
    a. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
    b. Measure and record motor electrical values for voltage and amperage.
    c. Manually operate dampers from fully closed to fully open position and record fan performance.

3.10 ADJUSTING

    a. Adjust damper linkages for proper damper operation.
    b. Comply with requirements in Division 20 Section 20 05 93 "Testing, Adjusting, and Balancing" for air-handling system testing, adjusting, and balancing.

3.11 OWNER ACCEPTANCE

4. The Owner will accept only complete, workable equipment and systems under the following conditions:

    1. After receipt by Owner of all the working drawings in “Approved” status by the Engineer.

    2. After completion of all specified testing and receipt of all test reports accepted by the Engineer.

3. After completion of all specified equipment cleaning, start-up, field testing and start up as specified herein and receipt by Owner of all specified certifications accepted by the Engineer.
4. Re-balance system following startup to align with new system requirements. See Testing and Balancing Specification for additional information.
5. Modify AHU controls as required to accommodate needs of new and existing areas served. See Controls Drawings, Specifications, and Cornell Design and Construction Standards for requirements.

END OF SECTION 237317

SECTION 238216 - AIR COILS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water heating coils.

1.02 RELATED REQUIREMENTS

A. Section 230719 - HVAC Piping Insulation.

B. Section 232114 - Hydronic Specialties.

C. Section 233100 - HVAC Ducts and Casings: Installation of duct coils.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

C. Certificates: Certify that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements.

D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.

B. Protect coils from entry of dirt and debris with pipe caps or plugs.

PART 2 PRODUCTS

2.01 WATER HEATING COILS

A. Tubes: 5/8 inch OD seamless copper or brass arranged in parallel or staggered pattern, expanded into fins, silver brazed joints.

B. Return bends to have 0.035" thickness.

C. Fins: Aluminum or copper continuous plate type with full fin collars.

D. Casing: Die formed channel frame of 16 gauge, 0.0598 inch stainless steel with mounting holes on 3 inch centers. Provide tube supports for coils longer than 36 inches.

E. Frames to be stainless steel.

F. Headers: Cast iron with tubes expanded into header.

G. Testing: Air test under water to 200 psi for working pressure of 200 psi and 220 degrees F.

H. Configuration: Drainable, with threaded plugs for drain and vent.

I. Fin Spacing: 8 fins per inch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install in ducts and casings in accordance with SMACNA (DCS).

1. Support coil sections independent of piping on steel channel or double angle frames and secure to casings.
2. Provide airtight seal between coil and duct or casing.
3. Refer to Section 233100.

C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

D. Install coils level. Install cleanable tube coils with 1:50 pitch.

E. Make connections to coils with unions and flanges.

F. Hydronic Coils:

1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide manual air vents at high points complete with stop valve.
3. Ensure water coils are drainable and provide drain connection at low points.

END OF SECTION 238216

SECTION 238219 - FAN COIL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ducted fan coil units and accessories.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Division 20, including all Common Mechanical Requirements in Section 200000, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 REFERENCE STANDARDS

A. AHRI 440 (I-P) - Performance Rating of Fan-Coil Units; 2019.

B. ASHRAE 33 - Methods of Testing Forced-Circulation Air-Cooling and Air-Heating Coils; Approved Edition.

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2025.

D. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

C. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.05 OPERATION AND MAINTENANCE MATERIALS

A. Operation and Maintenance Data: For fan coil units to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   a. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.06 WARRANTIES

1.07 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE Std 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.08 COORDINATION

A. Coordinate layout and installation of fan coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which fan coil units will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.

5. Items penetrating finished ceiling, including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
6. Perimeter moldings.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Fan Coil Unit Filters: Furnish one spare filters for each filter installed.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

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. Factory-packaged and -tested units rated according to AHRI 440 (I-P), ASHRAE 33, and UL 1995.

2.02 DUCTED FAN COIL UNITS

A. Fan Coil Unit Configurations: Row split.

   1. Number of Cooling Coils: One with two-pipe system.
   2. Number of Heating Coils: One with two-pipe system, where scheduled on Project Drawings as required.

B. Refer to Schedule on Project Drawings for required performance data and system capacities.

C. Coil Section Insulation: 1/2-inch- (13-mm-) thick, coated glass fiber complying with ASTM C1071 and attached with adhesive complying with ASTM C916.

   1. Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.
   2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE Std 62.1.

D. Main and Auxiliary Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE Std 62.1. Provide with drain pan overflow switch. The use of condensate pumps shall be minimized. Use only where absolutely necessary.

E. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panel.

F. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.

1. Provide with supply and return duct connections.
2. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis.
3. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
4. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

G. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE Std 52.2 and all addendums.

H. MERV Rating: 6 when tested according to ASHRAE Std 52.2.

1. Washable Foam: 70 percent arrestance and MERV 3.
2. Glass Fiber Treated with Adhesive: 80 percent arrestance and MERV 5.
3. Pleated Cotton-Polyester Media: 90 percent arrestance and MERV 7.

I. Hydronic Coils: Copper tube with corrosion-resistant coating, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), rated for a minimum working pressure of 200 psig (1378 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain.

J. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

1. Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. fan coil units to be provided with a maximum speed of medium, no more than 50% of fan speed.
3. Fan coil units to have fully modulating EC Motors.

K. Control devices and operational sequence are as specified in Section 230900 "Instrumentation and Control for HVAC" and on the Project Drawings.

L. Electrical Connection: Factory wire motors and controls for a single electrical connection. Provide with manufacturer toggle disconnect switch.

M. Units shall be factory assembled, tested, and shipped as one piece. All units shall be capable of meeting or exceeding the scheduled capacities for cooling, heating and air delivery. All unit dimensions for each model and size shall be considered maximums. Units shall be ETL listed in compliance with UL/ANSI Standard 60335, and be certified as complying with the latest edition of ARI Standard 440.

N. For exposed units, the side and bottom access panels shall be attached with quick open fasteners to allow for easy removal and access for service.

O. Use of manufacturer coil kits or combination devices is not allowed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, to receive fan coil units for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan coil unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install fan coil units level and plumb.

B. Install fan coil units to comply with NFPA 90A.

C. Suspend fan coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Verify locations of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) above finished floor.

E. Install new filters in each fan coil unit within two weeks after Substantial Completion.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect condensate drain to indirect waste.
    a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

B. Connect supply-air and return-air ducts to fan coil units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 DEMONSTRATION AND TRANING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan coil units.

END OF SECTION 238219

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Substitution of Materials.

B. Nameplates.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

C. Cornell University Design and Construction Standards

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.04 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority having jurisdiction

B. KCML: Thousand circular mils (formerly MCM).

C. MFR: Manufacturer

D. NEC: National Electrical Code, National Fire Protection Association, Publication #70.

E. NIC: Not in contract.

1.05 DEFINITIONS

A. Boxes:Outlet, junction or pull boxes.

B. Code: All applicable codes currently enforced at project location.

C. Compression: Compressed using a leveraged powered (Hydraulic or equivalent) crimping tool.

D. Connection: All materials and labor required for equipment to be fully operational.

E. Exterior location: Outside of or penetrating the outer surfaces of the building weather protective membrane.

F. Fully operational: tested, approved, and operating to the satisfaction of the building weather protective membrane.

G. Furnish: deliver to the jobsite.

H. Install: To enter permanently into the project and make fully operational.

I. Noted: Shown or specified in the contract documents.

J. Provide: Furnish and install.

K. Required: As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.

L. Shown: As indicated on the drawings or details.

M. Wiring: Raceway. conductors and connections.

1.06 SUBMITTALS

A. Submittals and Shop Drawings: Schedule so as not to delay construction schedule and no later than 60 days after award of contract, submit product data in PDF electronic submission form. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and resubmittal. Provide submittals for each product proposed for the project. See General Conditions for format, submission system and general requirements.

B. Submittals shall show:

1. Indicate listing by UL or other approved testing agency.
2. Highlight with yellow or blue marker adequate information to demonstrate materials being submitted fully comply with contract documents.
3. Review and check all material prior to submittal and stamp "Reviewed and Approved".

C. Shop drawings shall show:

1. Ratings of items and systems.
2. How the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
3. System layout floor plans with complete device layout, point-to-point wiring connection between all components of the system, wire sizes and color coding.
4. Riser diagrams showing vertical wiring between components.

5. Line diagrams and or logical/control schematics including interface to other systems as applicable. Provide point to point wiring diagrams, indicate terminal identification at item of equipment. Typical diagrams may be used when accompanied by wire schedules that are specific to each product.
6. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
7. Electrical rooms: Submit 1/2" = 1'0" detail plans and wall elevations of each room showing actual size of equipment in place. Identify coordinating elements such as structural beams or mechanical systems. Submittals shall show coordination among all suppliers of equipment, including power components, fire alarm, racks, nurse call, public address, security, etc. Submit room layouts at same time as material submittals, and prior to installation of any equipment.
8. List of all Division 23 equipment noting actual rating of equipment that will be installed. For discrepancies between the requirements of the proposed equipment and the equipment provisions indicated on the drawings, indicate the contractor's proposed no cost change to the electrical system to accommodate the submitted equipment.

D. Release of Drawing Data files

1. Contractor may request to utilize the project drawing data files for assistance in producing shop drawings. Request shall be made by signing owner/design team’s requested documentation for release of the data files.

E. The Contractor agrees:

1. Submittals and shop drawings processed by the Architect are not change orders.
2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
4. To accept all responsibility for assuring that all materials furnished under this Division of the specifications meet, in full, all requirements of the contract documents.
5. To pay for Engineers review cost of submittal review beyond one resubmittal.

F. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; performing his work in a safe and satisfactory manner.

G. Submittals and shop drawings are required per the individual sections and the submittals schedule at the end of this Section.

1.07 OPERATION AND MAINTENANCE MATERIALS

A. Provide O&M manuals required in Division 01 - General Requirements for all equipment furnished under Division 26 - Electrical of the specifications. Submit a preliminary copy, complete except for the bound cover, 60 days prior to completion of the project for checking and review. Deliver final bound corrected copies as noted in Division 1 - General Requirements 20 days prior to scheduled instruction periods. Obtain a receipt for the manuals and forward a copy of the receipt to the Engineer with the Job Completion Form.

B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:

1. Equipment manufacturer, make, model number, size, nameplate data, etc.
2. Description of system configuration and operation including component identification and interrelations. A master control schematic drawing(s) may be required for this purpose.
3. Dimensional and performance data for specific unit provided as appropriate.
4. Manufacturer's recommended operation instructions.
5. Manufacturer's recommended lubrication and servicing data including frequency.
6. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable. Include the parts list and part diagram that was included with the product's packaging, note that a "catalog cut" will not meet this criterion.
7. Shop drawings.
8. Wiring diagrams.
9. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation.
10. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.

D. Furnish complete wiring diagrams for each system for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless revised to indicate the exact field installation.

E. Group the information contained in the manuals in an orderly arrangement by specification index. Provide a typewritten index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 5" thick. (Provide two or more volumes if required.) Signal and communication systems shall be in separate volumes. Imprint the covers with the name of the job, Owner, Architect, Electrical Engineer, Contractor and year of completion. Imprint the back edge with the name of the job, Owner and year of completion. Hard board covers and literature contained may be held together with screw post binding.

1.08 RECORD DOCUMENTS

A. Record drawings shall be kept on: the contract drawings, shop drawings indicating field wiring, vendor diagrams indicating field wiring, and similar documents.

B. Continually record the actual electrical system(s) installation on a set of prints kept readily available at the project during construction. These prints shall be used for this purpose alone.

1. Mark record prints with red erasable pencil. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown.
2. Accurately locate with exact dimensions all underground and underslab raceways and stub-outs.
3. Note changes of directions and locations, by dimensions and elevations, as utilities are actually installed.
4. Include addenda items and revisions made during construction.
5. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.
6. Organize record drawings sheets in manageable sets, bind and print suitable titles, dates and other identification on the cover of each set.
7. Where “typical” wiring diagrams were used during submittals the record drawings shall indicate exact point to point wiring with exact terminal number designations.

C. Transmit the record drawing set to the Architect at the completion of the work. Final payment to the contractor will not be authorized until these prints have been submitted to and accepted by the Architect.

D. Transfer the changes marked up on the record prints into AutoCAD drawing files at the completion of the work. The version of AutoCAD shall not be earlier than the most recent version available at the date the project bids were received. AutoCAD files shall not include the stamp of the engineer of record. Provide two (2) sets of prints, one set of fixed line reproducible drawings and one set of AutoCAD drawing files on CD Rom. Transmit drawings, AutoCAD drawing files and the record drawing mark-ups to the Architect. Final payment to the contractor will not be authorized until these documents have been submitted to and accepted by the Architect

1.09 COORDINATION

A. Coordination during the bidding and pricing aspects of the contract includes determining where the work of other Divisions relies on the work of this Division for electricity and including the electrical system to match the requirements.

B. Coordinate work with that of the other Contractors and/or other trades doing work on the project. Examine all drawings and specifications of other trades for construction details and coordination. Make every reasonable effort to provide timely notice of work affecting other trades to prevent conflicts or interference as to space requirements, dimensions, openings, block-outs, sleeving or other matters which will cause delays or necessitate work-around methods.

C. Obtain submittals and shop drawings of all equipment with electrical connections furnished under other divisions of the specification and by the Owner. Provide all wiring in accordance with specific equipment requirements. Immediately advise the Architect of any changes which may affect the contract price.

D. Special attention is called to the following items. Coordinate all conflicts prior to installation:

1. Door swings such that switches will be located on the "strike" side of the door.
2. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
3. Location of cabinets, counters and doors so that electrical outlets, lighting fixtures and equipment are clear from and in proper relation to these items.
4. Recessing and concealing electrical materials in CMU walls, concrete construction and precast construction.
5. At each switchboard, panelboard and motor control center location the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.
6. Review specifications for other Divisions of the work to determine where other Divisions are requiring electrical connections. Verify electrical provisions shown on contract drawings by examining shop drawing submittals of other Divisions prior to submission to the owner. Do not proceed with ordering of supporting electrical equipment, such as circuit breakers, until electrical characteristics are verified. Proceed with rough-in only after verification of shop drawings.

E. Digital format copies of bid drawings will be furnished to the successful bidder. Augment bid documents with additional information to ensure coordination between trades. Provide digital format electrical systems drawings showing all ceiling devices, fixtures, raceways and cable tray locations and routing to mechanical contractor to be used for coordination drawings provided by mechanical contractor. Include dimensions and elevations of devices, fixtures, raceway and cable tray.

F. Furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required for the electrical systems shown or noted in the contract documents to be complete, fully operational and fully tested upon completion of the project. Raceways, boxes and ground connections are shown diagrammatically only and indicate the general character and approximate location. The layout does not necessarily show the total number of raceways or boxes for the circuits required, nor are the locations of indicated runs intended to show the actual routing of the raceways.

1. Where routings of major raceways and telecommunication pathways are indicated on plan sheets, the routing information supplements the information on diagrams. If no routing information is shown, route the systems in a manner that will coordinate with new and existing infrastructure and the work of other trades.

G. The horsepower of motors and apparatus wattage's shown on the drawings are estimated requirements of equipment furnished under other Divisions of this contract. Provide overload elements to suit actual equipment nameplate current. Where connections to variable speed drives furnished under other sections of this specification are shown, obtain the drive input current and verify the indicated drive circuit is compatible. Advise Architect of any equipment changes or substitutions affecting electrical systems.

H. Consult the architectural drawings for the exact height and location of all electrical equipment not specified herein or shown on the drawings. Make any minor changes (less than 6'-6" horizontal) in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.

I. Provide inserts or sleeves for outlet boxes, conductors, cables and/or raceways as required. Coordinate the installation thereof with other trades.

J. The Contractor will not be paid for relocation of work, cuttings, patching and finishing required for work requiring reinstallation due to lack of coordination prior to installation.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions of the Contract.

1.11 SUMMARY DESCRIPTION

A. This section includes general electrical requirements for all Division 26 work and is supplemental and in addition to the requirements of Division 1. See Division 01 for sequence of work.

B. It is the intention of this Division of the Specifications and the Contract Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete electrical system. Provide all materials, appliances and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all electrical systems shown on the contract drawings or described herein. Connect equipment and devices furnished and installed under other Divisions of this specification (or the Owner) under this Division.

C. Workmanship shall be of the best quality and competent and experienced electricians shall be employed and shall be under the supervision of a competent and experienced foreman.

D. The drawings and specifications are complimentary and what is called for (or shown) in either is required to be provided as if called for in both. Where conflicting information occurs within the drawings and specifications or between the drawings and specifications, the more expensive alternative shall be used as a basis for bidding and construction.

E. Branch Circuit Wiring: Where the drawings identify circuit numbers for items requiring electrical power, but do not indicate the manner of the wiring between the item and its source, the manner of the wiring shall be devised by the contractor utilizing the following provisions:

1. Wire sizes:
    a. Derate wiring for thermal restrictions imposed by the National Electrical Code.
    b. If wire sizes are not otherwise indicated, wire sizes shall limit the voltage drop for circuits serving general purpose receptacles(180VA per strap) to less than 3%, based on the receptacle in the circuit that is farthest from the source being utilized with a load of 14 amps at 80% power factor. The following wire sizes and circuit lengths comply with this requirement:

1) #12 up to 90 feet
2) #10 up to 125 feet
3) #8 up to 190 feet

c. Wire sizes for other loads shall limit the voltage drop to less than 3% based on the load indicated on the panel schedule.

2. Multiwire circuits: Multiwire circuits shall not be used unless specifically indicated or noted on the drawings. Provide a dedicated neutral conductor for each single pole circuit breaker.
3. Do not combine wiring of different source panels in the same raceway system, unless the panels are interconnected with sub feed or through feed lugs with no intervening disconnecting means.
4. Outlet and junction boxes: Arrange wiring extensions from junction boxes to outlet boxes to restrict the number of wires in an outlet box as required by NEC Article 314.
5. Single tubular raceways extending into panels or switchboards shall not contain more than 20 wires.

1.12 WORK IN OTHER DIVISIONS

A. Refer to Division 27 for Communications and Division 28 for Electronic Safety and Security. System elements of those Divisions require conformance and integration with the work of Division 26.

1.13 CODES, PERMITS, INSPECTION FEES

A. The following codes and standards are referenced in the Division 26 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:

1. American National Standards Institute (ANSI)
2. National Electrical Manufacturer's Association (NEMA)
3. National Fire Protection Association (NFPA)
4. Underwriter's Laboratories (UL)
5. National Electrical Contractor’s Association (NECA)
6. Install the electrical systems based on the following:

NFPA 70	National Electrical Code as adopted and amended by the Local Jurisdiction.
IBC	International Building Code as adopted and amended by the Local Jurisdiction.

7. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

8. Obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

B. Inspections

1. Inspections shall be conducted by the local Authority Having Jurisdiction (AHJ) (e.g.) City of Ithaca, Town of Ithaca). However, State campus buildings fall under the State of New York jurisdiction and shall be inspected by the Contract College Facilities' Code Enforcement Officer. The electrical contractor shall furnish the original Certificate of Inspection to the Project Manager and/or Engineer of Record with the following items before submitting their final payment application
   a. Temporary inspection of electrical work for temporary power for the job site and contractor trailers requiring power
   b. Temporary inspection of building primary and secondary power systems, before energizing building permanent power.
   c. Final inspection of the completed electrical system.
2. A project punch list/walk-through shall be conducted with the contractor, Engineer of Record, and Project Manager to review the work and ensure it has been constructed as specified in the contract documents, and that all labeling has been completed.

1.14 CORRECTION OF WORK

PART 2 PRODUCTS

2.01 GENERAL

A. All materials and equipment installed shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Authority Having Jurisdiction (Inspector).

B. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designated to insure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

C. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.

D. All materials, equipment and systems furnished that include provisions for storing, displaying, reporting, interfacing, inputting, or functioning using date specific information shall perform properly in all respects regardless of the century. Any interface to other new or existing materials, equipment or systems shall function properly and shall be century compliant, both in regards to information sent and received.

2.02 SUBSTITUTION OF MATERIALS

A. No Substitute:

1. Where a specified product is indicated "no substitute", it is the intent of this specification to require new materials to be compatible with the existing installation or as specifically requested by the owner. To this end certain materials and systems no substitution will be allowed.

B. Prior to Bid Opening:

1. Acceptance of products other than those specified will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:
2. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be neatly marked with yellow felt tip marker to clearly define and describe the product for which listing is requested.
3. Include certified laboratory test report for lighting fixtures.
4. Samples shall be submitted if requested.
5. Requests shall be received 10 days prior to bid opening.
6. Requests containing insufficient information to confirm compliance with contract documents will not be considered.

C. After Award of Contract:

1. Substitution of products will be considered after award of contract only under the following conditions:
2. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products can not be delivered to the project to meet the Owner's construction schedule.
3. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
4. The specified product is no longer manufactured.
5. There is compelling economic advantage to the Owner.

D. In all cases, should a substituted material result in requiring electrical system or building modifications; the Contractor alone shall pay all costs to provide these modifications including all costs to the Engineer and Architect for redesign, and updating of record drawings required to accommodate the required modifications.

2.03 NAMEPLATES

A. Provide nameplates per Section 260553 - Identification for Electrical Systems.

PART 3 EXECUTION

3.01 GENERAL

A. All work shall be done in accordance with NECA construction standards.

B. Adhere to industry standards of care for safety, including:

1. Occupational Safety and Health Act.
2. Accident Prevention Manual for Industrial Operations, National Safety Council.
3. ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces.
4. American National Standards for Personnel Protection: Lockout/Tagout.
5. Applicable state and local safety operating procedures.

3.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft. Handle all equipment carefully to prevent damage, breakage, denting, and scoring of finishes. Do not install damaged equipment.

B. Store products subject to damage by the elements above ground, undercover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instruction.

3.03 CUTTING BUILDING CONSTRUCTION

A. Obtain permission from the Architect and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.

B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.04 PENETRATION OF BUILDING ELEMENTS

A. General:

1. Penetrations of building elements by electrical systems shall not compromise the performance and integrity of the building element (structural, fire, smoke, waterproof, etc.)

B. Fire and smoke rated elements:

1. Electrical penetrations of fire and smoke rated floor and wall assemblies shall maintain fire-resistance or smoke barrier rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.05 PAINTING

A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.06 EQUIPMENT CONNECTION

A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide all electrical connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. Investigate existing equipment to be relocated and provide new connections as required.

B. Contract Coordination: Investigate vendor equipment proposed for installation and address and integrate the following into the construction process:

1. Special equipment requirements identified in shop drawings or submittals.
2. Equipment requirements for distribution system performance, for example, an external disconnect switch or fused disconnect switch to provide compliance with a governing code, a short circuit current rating, or a listing.

C. Obtain rough-in requirements for equipment furnished under other divisions of this specification prior to roughing-in.

3.07 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

1. Wipe surfaces of electrical equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
2. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy LED drivers and starters in fluorescent, high pressure sodium, metal halide, and mercury vapor fixtures to comply with requirements for new fixtures.

3.08 TESTING AND DEMONSTRATION

A. Demonstrate that all electrical equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any electrical equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

B. Contractor shall remove and replace covers of electrical equipment, open manholes and remove/replace ceiling tiles to permit engineer to observe equipment and wiring provided. For manholes: Furnish OSHA safety compliant equipment and personnel, including ventilation, safety harness, ladder and flashlight.

END OF SECTION 260500

SECTION 260510 - EXISTING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Existing Materials.

B. Existing Materials to be Installed.

C. Existing Materials not to be Reinstalled.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 260500 - Common Work Results For Electrical.

1.04 REFERENCE STANDARDS

A. Reference documents including record drawings and "as built's of existing systems are included with the construction documents. The contractor shall asses the accuracy of these documents during pre-bid walk through and adjust his bid to accommodate discrepancies between the documents and actual conditions.

1.05 INDICATED EXISTING SYSTEMS

A. The electrical drawings show portions of the existing electrical systems which are to remain, be removed or be modified. The existing information is derived from record drawings and other data obtained from or with the permission of the owner. Where indicated, concealed systems are also derived from record drawings and the Engineer's best judgment of the configuration.

B. The Contractor shall inspect the existing installation prior to bidding and shall judge the work required. Inspection shall include areas within and adjacent to the work of any discipline or trade performing work for the contract.

C. The complete extent of the existing systems could not be verified during creation of the construction documents. Unless the contractor's inspection of the existing system determines a greater amount, the contractor shall assume there is 20% more existing electrical systems than what is indicated on the contract drawings.

1.06 POWER OUTAGES

A. The facility will continue its normal operation during construction; the Contractor shall schedule electrical system(s) outages with the Owner. Electrical system(s) outages to Owner occupied areas shall not be permitted from 7:00 a.m. to 6:00 p.m. on any day of the week.

B. This facility will be in operation 24 hours a day seven days a week during the construction work; therefore it is required that the Contractor fully schedule electrical system(s) outages with the Owner. Contractor shall work closely with Owner to assure the Owner fully understands the extent of each outage. Owner maintains the right to limit the extent and length of any given outage. Assume all outages to Electrical system(s) in Owner occupied areas will require premium time and that temporary electrical work may be required to limit the duration of outages.

C. Cutovers must make alternative arrangements to deliver power to the load at all times

D. Cutovers must be accomplished in a minimum of hours.

E. Submit a written request for a power outage at least one week in advance identifying the areas and systems that will be affected, time and duration of the power outage. The Contractor shall receive written authorization to proceed with the outage and shall re-notify the Owner verbally at least one hour prior to the outage and also notify the Owner when the outage is completed.

F. Unscheduled Outages: In the event that the Contractor's work causes or contributes to an electrical system(s) outage (or other system fault), the Contractor is responsible for immediately correcting the problem. Included (as examples) shall be any premium time required to stay on the job site until problem is corrected and air freight for parts not locally available. Any damage resulting from performance of work under this contract shall be repaired to assure continuing facility operation and integrity, at no increase in contract cost.

PART 2 PRODUCTS

2.01 EXISTING MATERIALS

A. All materials which are a part of the building shall remain the property of the Owner.

2.02 EXISTING MATERIALS TO BE REINSTALLED

A. Existing materials and equipment (except interior, undamaged raceways) that are removed as a part of the work or stored in surplus shall not be reinstalled as a part of the new systems unless specifically noted or authorized in writing by the Owner. Forward a copy of the authorization to the Engineer. The requirements of the specifications (i.e., condition, installation, testing, etc.) shall apply as if the materials were new, furnished by the Contractor.

2.03 EXISTING MATERIALS NOT TO BE REINSTALLED

A. In coordination with the Architect, these materials shall be made available for his inspection and decision as to whether the Owner will retain possession. Items selected for retention shall be turned over to the Owner. These items shall be delivered to a location on the premises selected by the Owner. Take reasonable care to avoid damage to this material. If the Contractor fails to conform to this requirement, he shall purchase and turn over to the Owner replacement material of like kind and quantity.

B. All material not selected for retention by the Owner and debris shall be legally disposed of by the Contractor.

PART 3 EXECUTION

3.01 EXISTING CONDITIONS

A. Examine the structure, building, and conditions under which electrical work is to be installed for conditions detrimental to proper and timely completion of electrical work. Do not proceed with work until deficiencies or detrimental conditions have been corrected. Report deficiencies or detrimental conditions of existing electrical work which might be unsuitable to connect with or receive other work. Failure to so report shall constitute acceptance of other work as being fit and proper for the reception of electrical work.

B. Field trace all existing circuitry affected by the project to determine:

1. Source of supply or information collection point within the project area
2. Load or termination within the project area
3. Load or termination outside the project area, but supplied from or connected to equipment within the project area
4. Loads supplied from and located outside of the project area, but have circuitry within the project area.

3.02 REMOVAL

A. All removal work required under this contract is not shown on the electrical drawings. Refer to work of other divisions for contract work that may affect existing electrical systems. Coordinate work between trades prior to bid.

B. Switchboards, panelboards, signaling and communication systems, other electrical equipment free standing or surface mounted, raceway (exposed) and conductors; which are not presently in service or will not be in service as a result of this contract shall be removed.

C. Contractor shall remove all floor, wall or ceiling mounted outlet devices in the "Removal" or "Demolition Area" indicated on the drawing, even if the equipment/or device is not individually shown on the project drawings. Unused flush mounted devices, outlet and other boxes in finished areas shall be removed from wall and the remaining hole patched to match adjacent wall surfaces.

D. Unused raceways and wire shall be removed back to source if accessible, otherwise cut flush at ceiling, floor or wall and fill with grout.

E. If Contractor questions whether a particular device is to be removed notify the Architect noting type and location of device. If so directed the Contractor shall maintain the existing device in service without any change in contract price.

F. Contractor shall divert all electrical demolition materials including, but not limited to copper and aluminum cabling, fixture ballasts and lamps, enclosures, raceways and bus ducts, to either a local recycling station or to the on-site recycling station as provided by the General Contractor or Owner.

3.03 EXISTING SYSTEMS MAINTAINED

A. Maintain existing systems not identified for demolition. Maintaining existing systems includes relocating the systems to coordinate with work of this contract, when work of this contract cannot be done while the existing system is in its present location.

B. Any existing wiring serving devices to remain in service and which may be affected by work performed under this contract shall be rerouted to maintain circuit continuity. Contractor shall assume the risk of maintaining existing systems, except relocation of wiring of #2 AWG and above shall be considered an additional cost if not shown to be relocated. If such wiring is found the Contractor shall notify Architect Owner of wiring location, reason it must be removed and cost of relocation and receive the Owner's approval before proceeding with the work.

C. Examine drawings of all disciplines to determine where work of other trades will or is likely to require relocation of existing systems. Remove and relocate electrical equipment in the way of work of other trades. Exact relocation requirement of existing systems to remain to be based on detailed coordination with other trades. Contractor to provide proposed locations of relocated devices to Owner for approval prior to commencement of work.

D. Relocation of any system shall be permanent.

E. Re-route existing circuits that are affected as a result of this contract that serve devices to remain in service.

1. Power Circuits (Including removal or relocation of existing panelboards).
    a. Prior to demolition work trace out and identify each branch circuit and feeder circuit that serves loads in occupied areas.
    b. Provide temporary wiring, schedule outage and reconnect loads to temporary wiring.
    c. Provide new wiring in new location.
    d. Schedule outage, disconnect temporary wiring, and connect loads to new wiring. Remove temporary wiring.
    e. Outage for each circuit shall not be more than 20 minutes.
2. Signal and Communication Systems
    a. Prior to demolition trace out and identify device and systems being served.
    b. Provide temporary wiring to maintain operation of system throughout facility.
    c. Schedule outage and connect to temporary wiring and test system.
    d. Provide new wiring on new location.
    e. Schedule outage, disconnect temporary wiring, and reconnect to new wiring. Remove temporary wiring.

f. Outage for each system shall not be more than 20 minutes.

3.04 EXISTING SYSTEMS UPGRADED

A. Provide new raceway support system for all existing raceways that are to be maintained in the project area in accordance with Section 260533 - Raceways and Boxes for Electrical Systems .

B. Provide an allowance of 100 strap supports to be used to support any existing unsupported Division 26, Division 27 or Division 28 system. Provide report at weekly construction meetings indicating the number of strap supports installed the previous week.

3.05 TEMPORARY ELECTRICAL SYSTEMS

A. Provide temporary lighting, exit lighting, and fire notification in areas of construction that will have ongoing or intermittent public access. Temporary lighting shall comply with IES standards and other provisions of these specifications. Selected light fixtures must have battery backup to allow for egress at all times. Indicate path to nearest exit with exit signs. All temporary systems shall be removed after they are no longer in operation.

B. Removing, temporary installation, and reinstalling in ceilings of light fixtures, speakers, detectors, exit signs and other electrical equipment is not shown on the drawings. The Contractor shall investigate the ceiling demolition work and include appropriate temporary work in the bid. The sequence of work shall be (1) Remove and store fixtures, detectors and speakers along with removal of ceiling, (2) Provide temporary support for wired fixtures and devices to be reinstalled in new ceiling at approximately the same location. Use chains for lighting fixture support. (3) Clean and reinstall in the new or replaced ceilings. Provide new lamps when so noted. Provide temporary relocation of exit signs to original location when exit is reactivated.

3.06 WORK OUTSIDE OF REMODEL AREAS

A. Provide new wiring systems in concealed ceiling spaces, unless the structure is open to the floor below.

B. For work outside of the project area assume that removal and replacement of ceiling tiles is required in all finished areas. Spaces above existing ceilings are highly congested.

C. Route wiring around obstructions and provide pull boxes per code. Carefully remove, store or temporarily hang and re-install in undamaged condition all electrical equipment, lighting fixtures and ceiling tiles where access to perform work is required. Clean prior to re-installation. Provide new lamps when so noted.

3.07 START UP SERVICE

3.08 DEMONSTRATION AND TRAINING

3.09 NEW DEVICES IN REMODEL AREAS

A. Provide flush mounting for devices in existing walls. Fish conduit in wall. Where existing boxes are indicated to be reused, extend box as necessary and provide new devices and plates.

B. Contractor is cautioned that the existing building contains clay tile and concrete walls. New devices may require cutting and patching, and it shall be the responsibility of the contractor to provide all cutting and patching required for the installation of the Division 26 work. Contractor shall investigate existing areas prior to bid and shall include all costs of such work in the bid.

C. This facility has wiring embedded in raceways in concrete slabs. Provide new concealed wiring to last outlet or pull box before homerun to panel.

END OF SECTION 260510

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conductors and Cables.

B. Connectors and Splices.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.04 ABBREVIATIONS AND ACRONYMS

1.05 REFERENCE STANDARDS

A. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

B. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

1.06 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

C. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

D. Wire Pulling Lubricant: Certification of compatibility with conductors/cables where used with the following insulation/jacket types:

1. Low-smoke zero halogen (LSZH).
2. Low-density polyethylene (LDPE).

E. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 TESTING

1.09 MOCK-UPS AND SAMPLES

1.10 COORDINATION

A. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

B. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping, structural foundations, or other potential conflicts.

C. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

D. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.12 EXTRA MATERIALS

A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Manufactured Wiring Systems Cable Assemblies: One of each configuration, 6 feet length.

1.13 SUMMARY DESCRIPTION

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. General Cable Corporation.
3. Alpha Wire
4. Southwire Company.
5. Encore Wire Corporation

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, and SO.

D. Multi-conductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and Type SO with ground wire. Metal-clad cable armor shall be steel.

2.02 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.
6. Thomas & Betts

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material type, and class for application and service indicated.

C. Push in connectors shall not be provided.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Stranded.

B. Branch Circuits: Copper. Unless indicated otherwise, solid for conductors #10AWG and smaller, stranded for conductors #8AWG and larger.

C. Equipment circuits shall be copper, where required by manufacturer's recommendations or direction.

D. Minimum Conductor Sizes:

1. Feeders and Branch Circuits: No. 12 AWG.
2. Class 1 Control Circuits: No. 14 AWG.
3. Class 2 Control Circuits: No. 16 AWG.

E. Unless indicated otherwise or required for vo, power circuits shall be 2#12, 1#12G, ¾"C.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Feeders installed below Raised Flooring:

1. Type THHN-THWN-2, single conductors in raceway

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Inaccessible Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits in Accessible Ceiling Spaces:

1. Type THHN-THWN, single conductors in raceways, or
2. Type MC Cable in lengths 6’-0” or less and for use as a master slave connection between light fixtures.

H. Branch Circuits Gypsum-Board Partitions:

1. Type THHN-THWN, single conductors in raceways.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

K. Class 1 Control Circuits: Type THHN-THWN, in raceway.

L. Class 2 Control Circuits: Type THHN-THWN, in raceway, Power-limited cable, concealed in building finishes (not allowed in exposed ceiling of finished spaces), or Power-limited tray cable, in cable tray.

M. Motor branch circuits, which include a variable frequency drive (VFD): Provide VFD cable from the source overcurrent protection device to the motor. Shields shall be maintained electrically continuous and shall be terminated to the building ground system.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. For circuits that require a neutral conductor, provide a dedicated neutral back to the panelboard.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.

D. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

E. Do not install conductors supplied from different panelboards, distribution panels, or switchboards in same conduit or raceway, unless otherwise noted.

F. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

G. Install cables parallel and perpendicular to surfaces of structural members, and follow surface contours where possible.

H. Do not route cables directly into through panelboards, switchboards, motor starting equipment and similar equipment, as part of the cable pathway.

I. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 FIRESTOPPING

A. Penetrate fire barries, smoke barriers, vapor barriers, roofing materials and other rated architectural elements in a manner that preserves the rating fo the architectural element.

B. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
2. Perform each electrical, visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, including but not limited to the following:
   a. Bolted connection resistance,
   b. Insulation resistance with respect to ground and adjacent conductors,
   c. Continuity verification,
   d. Phase verification,
   e. Resistance of parallel conductors.
3. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

3.07 VOLTAGE DROP

A. Voltage drop shall not exceed two percent for feeder conductors.

B. Voltage drop shall not exceed three percent for branch conductors. Refer to table below for maximum permitted branch conductor lengths at rated voltages for indicated OCP. Where lengths are exceeded due to revised routing, calculate the voltage drop and provide the appropriate conductor size to achieve the maximum allowable voltage drop.

Voltage Configuration	#12 AWG 20 amp OCP	#10 AWG 20 amp OCP	#10 AWG 30 amp OCP	#8 AWG 40 amp OCP	#6 AWG 50 amp OCP
120V, single phase	56 feet	93 feet	62 feet	72 feet	91 feet
208V, single phase	97 feet	162 feet	108 feet	124 feet	159 feet
240V, single phase	112 feet	187 feet	125 feet	144 feet	183 feet
277V, single phase	129 feet	216 feet	144 feet	166 feet	211 feet
480V, single phase	225 feet	374 feet	249 feet	288 feet	367 feet
208V, three phase	112 feet	187 feet	100 feet	115 feet	133 feet
240V, three phase	103 feet	173 feet	125 feet	144 feet	183 feet
480V, three phase	259 feet	433 feet	288 feet	333 feet	424 feet

a. Note: Table assumptions include copper conductors at 80% load capacity, 1.0 power factor, 75ºC temperature rating, EMT conduit, and three percent voltage drop.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conductors.

B. Connectors.

C. Grounding Electrodes.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.05 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Shop Drawings:

1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

2. Submit a detail for each type of grounding electrode. Indicate type, material, size and means of connecting to the grounding electrode system.
3. Floor plan marked for each location proposed for connection to vertical steel structural columns and concrete footings to be bonded to the grounding electrode system.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field quality control test reports.

E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 COORDINATION

A. Verify exact locations of underground metal water service pipe entrances to building.

B. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.

C. For signal reference grids, coordinate the work with access flooring furnished in accordance with Section 096900.

D. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 24”L by 1/4”D by 2”H, unless otherwise indicated; with insulators.

2.02 CONNECTORS

A. Manufacturers:

1. Thomas & Betts
2. Burndy
3. nVent

B. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

C. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

E. Compression Connectors: Irreversible, factory filled with an oxide inhibitor. Connectors must comply with IEEE 837, UL 467 and CSA 22.2.

PART 3 EXECUTION

3.01 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

E. Signal and Communication Equipment: For telephone, alarm, voice and data equipment rooms, MDF and IDF rooms, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 24-by-1/4-by-2-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.02 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Wiring Devices:

1. Install a 6 inch green insulated pigtail from grounding terminal of wiring device to device box and equipment grounding conductor.
2. For lighting fixtures, install insulated grounding conductor and terminate to terminal on lighting fixture housing.
3. For electric motors, install an insulated equipment grounding conductor in branch circuit serving each electric motors, and bond to motor frame.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

E. Transformer Secondary Neutrals:

1. Provide No. 2 AWG minimum insulated copper grounding conductor, in raceway from grounding electrode system to transformer housing. Terminate to transformer XO connection.
2. Provide No. 3/0 minimum insulated copper grounding electrode conductor from transformer XO connection to building steel. Exothermically weld to building steel.
3. Looping grounding conductors from transformer to transformer shall not be allowed.

F. Cable Tray: Provide bonding jumpers to make cable tray electrically continuous throughout. Provide No. 4 AWG minimum insulated copper grounding conductor in raceway from grounding electrode system to cable tray system, bonded to cable tray.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.04 APPLICATION

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.stranded unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, in MDF and IDF rooms, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
3. Provide No. 3/0 AWG minimum insulated copper grounding conductor in raceway from grounding bus to neutral bus in service entrance equipment.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground or Encased in Concrete Connections: Welded or compression, except at test wells and as otherwise indicated.
3. Aboveground and exposed: Welded or compression connectors except at test wells and as otherwise indicated. Compression and installed with the same manufactures die so that the die index matches the listed index on the connector. Connector must be fully crimped with a 14 ton or larger hydraulic tool so that the index number is indented on the connector. Irreversible compression connectors may be used in below grade, above grade, building steel, electrode connections or concrete incased applications.
4. Connections to Ground Rods at Test Wells: Bolted connectors.
5. Connections to Structural Steel: Welded connectors.
6. Compression connectors shall be installed with the same manufactures die so that the die index matches the listed index on the connector. Connector must be fully crimped with a 14 ton or larger hydraulic tool so that the index number is indented on the connector.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support, Anchorage, and Attachment Components.

B. Fabricated Metal Equipment Support Assemblies.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. MFMA-4 - Metal Framing Standards Publication; 2004.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

D. MSS SP-69 - Pipe Hangers And Supports - Selection And Application; Approved Edition.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2016.

1.05 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

1. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

C. Installer's qualification statement.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 COORDINATION

A. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.

B. Coordinate work to provide additional framing and materials required for installation.

C. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.

D. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.

E. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.08 DELIVERY, STORAGE AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems (Adjustable and Fixed Length): Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.01 APPLICATION

A. Comply with NECA 1, and NECA 101, and the NEC for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where it's Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with clamps approved for the application by an agency acceptable to the authorities having jurisdiction.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Existing Concrete: Expansion anchor fasteners.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate [by means that meet seismic-restraint strength and anchorage requirements].

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

F. Adjustable length slotted steel supports shall be clamped to a fixed length, per manufacturer's instructions to maintain weight support restrictions recommended by the manufacturer.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal Conduit and Tubing.

B. Non-Metallic Conduit and Tubing.

C. Metal Wireways.

D. Non-Metallic Wireways.

E. Surface Raceways.

F. Boxes, Enclosures, and Cabinets.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

1.04 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.05 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components, include plans, elevations, sections, details, and attachments to other work:

1. Custom enclosures and cabinets.
   a. Coordination

C. Source quality-control test reports.

1.06 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

1.07 COORDINATION

A. Create Coordination Drawings for use in raceway installation.

1. Create conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   a. Structural members in the paths of conduit groups with common supports.
   b. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.08 SUMMARY DESCRIPTION

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work limited to, the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. Thomas & Betts

B. Rigid Steel Conduit: ANSI C80.1.

C. EMT: ANSI C80.3.

1. ANSI C80.3 american national standard for electrical metallic tubing steel

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: set screw type.
2. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with the provided raceways as required for complete system.

G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

2.03 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Legrand Cablofil
4. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, Type 1 , unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Small sizes (4 inches by 4 inches and smaller) shall be hinged type with fastening device. Larger sizes shall be provided with a screw-cover and gasket.

E. Finish: Manufacturer's standard enamel finish.

2.04 SURFACE RACEWAY SYSTEMS

A. Manufacturers:

1. Hubbell Incorporated Model DS4000
2. Legrand North America

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.

C. Surface Raceway System:

1. Raceway Type: Two compartment, painted steel.
2. Size: 5-1/2" x 2-1/2"
3. Length: As indicated on the drawings.
4. Color: To be selected by Architect.
5. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.
6. Integrated Device Provisions:
   a. Receptacles:
      1) Comply with Section 262726, except for finishes.
      2) Configuration: As indicated on the drawings.
      3) Color: To be selected by Architect.
   b. Communications Outlets:
      1) Voice and Data Jacks: As specified in Section 271000.

2.05 SURFACE RACEWAYS

2.06 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Legrand Wiremold
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1, one piece cold drawn type, welded boxes are not acceptable..

1. NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, with gasketed cover.

F. Dividers: Provide listed dividers inside multi-gang boxes where required to separate phases.

G. Metal barriers to separate wiring of different systems and voltages exceeding 300V150V.

H. Hinged-Cover Enclosures: NEMA, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic [finished inside with radio-frequency-resistant paint].

I. Cabinets:

1. NEMA Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

1. NECA 1 STANDARD FOR GOOD WORKMANSHIP IN ELECTRICAL CONSTRUCTION

B. Keep raceways at least 8 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Install raceways parallel to building lines.

D. Install raceway expansion fittings at building expansion joints [and at the addition connection to the existing building], parallel to building lines.

E. Complete raceway installation before starting conductor installation.

F. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

G. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

J. Raceways Embedded in Slabs:

1. Conduits embedded in slabs shall not be larger than 1-inch diameter. Multiple parallel embedded conduits shall be spaced a minimum of 4-inches on center.
2. Run conduit parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
3. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Provide insulating and grounding bushings at junction boxes, outlet boxes, and cabinets for conduits one-inch and larger in diameter.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by .

P. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

Q. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

R. Set metal floor boxes level and flush with finished floor surface.

S. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.02 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Coordinate installation of PVC coated conduit with factory authorized representative.
3. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.04 APPLICATION

A. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: Rigid steel conduit, IMC or EMT.
2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.

3. Concealed in Ceilings and Interior Walls and Partitions: Rigid steel conduit, IMC or EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit or IMC.
6. Boxes and Enclosures: NEMA EN 10250, Type 1, except useNEMA, Type 4,stainless steel in damp or wet locations.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway. Conduit ends shall be provided plastic bushings.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Plenum-type, optical fiber/communications cable raceway. Conduit ends shall be provided plastic bushings.

B. Minimum Raceway Size: 1/2-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

D. Conduits shall be routed inside the building, in lieu of exposed across the roof, unless indicated otherwise.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Raceway and Metal-Clad Cable Identification Materials

B. Conductor and Communication- and Control-Cable Identification Materials

C. Warning Labels and Signs

D. Instruction Signs

E. Equipment Identification Labels

F. Miscellaneous Identification Products

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.145 - Accident Prevention Signs and Tags; Current Edition.

B. ANSI A13.1 - Scheme for the Identification of Piping Systems; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

C. Samples:

1. Identification Nameplates: One of each type and color specified.

2. Warning Signs and Labels: One of each type and legend specified.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 COORDINATION

A. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

PART 2 PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. More than 600V Warning: “DANGER – HIGH VOLTAGE – KEEP OUT.”
4. 480V Warning: “480 VOLTS.”
5. Phase Color-Coding of 208Y/120V panelboards: “PHASE A - BLACK, PHASE B RED, PHASE C BLUE, NEUTRAL WHITE, GROUND GREEN.”
6. Phase Color-Coding of 480Y/277V panelboards: “PHASE A - BROWN, PHASE B ORANGE, PHASE C YELLOW, NEUTRAL GRAY, GROUND GREEN.”

2.04 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device. Where used on electrical equipment and enclosures also use screws to fasten in place.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Fasten signs and labels to electrical equipment and enclosures with screws.

G. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 6 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208Y/120-V Circuits: :
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral: White.
   e. Ground: Green.
3. Colors for 480/277-V Circuits: :
   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray.
   e. Ground: Green.
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

K. Branch and Feeder Circuit Load Identification Labels: On each overcurrent protective device, install unique load designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

   1. Labeling Instructions:
      a. Panelboard Circuit Directories: Provide type-written or laser printed circuit directory on heavy card stock. Arrange in two columns with odd numbered circuits on left and even numbered circuits on right. Include panelboard identification and installation date. Indicate spare circuit breakers: “SPARE”. Install in metal frame with clear plastic cover. Coordinate with the Owner’s final room numbering system.
      b. Overcurrent Protective Devices Installed in Distribution Panels and Switchboards: Engraved, laminated acrylic or melamine labels. Unless otherwise indicated, provide a single line of text with 3/8-inch high letters on 3/4-inch high label; where 2 lines of text are required, use labels 1.5 inches high.

L. Independent Support Wire: Where independent support wires are permissible and utilized for securing electrical raceways, cable assemblies, boxes, cabinets, or fittings within ceiling cavities, they shall be distinguishable from ceiling support wires by color, tagging, or other effective means.

3.02 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A: Identify with orange snap-around label or stenciled legend adjacent to each junction box, pull box, and electrical enclosure.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, snap-around, color-coding bands, or stenciled legend:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape, marker tape, or write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Use marker tape or write-on tags in each junction or pull box. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags or marker tape to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs or metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70 : Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
3. Panelboards rated 208Y/120V or 480Y/277V: Apply phase color-code identification label to door or cover of equipment in including the following:
   a. Panelboards.
   b. Power Panels.
   c. Distribution Panels.
   d. Switchboards.
   e. Motor Control Centers.
4. Equipment Rated 480 V: Unless otherwise indicated, apply to door or cover of equipment. Apply to inside door or cover of flush panelboards and similar equipment in finished spaces.
5. All power distribution equipment: Apply arc flash labels required by code or other sections of the Specification.

H. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high. For single-gang motor starting switches, use 3/8-inch high letters on 3/4-inch high by 2.25-inch wide label; for two-gang motor starting switches, use 3/8-inch high letters on 3/4-inch high by 4 inch wide label
   b. Outdoor Equipment: Engraved laminated acrylic, melamine label, or stenciled legend 4 inches high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Electrical switchgear and switchboards.

d. Transformers.
e. Emergency system boxes and enclosures.
f. Disconnect switches.
g. Enclosed circuit breakers.
h. Motor starters.
i. Push-button stations.
j. Contactors.
k. Fire-alarm control panel and annunciators.
l. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.

J. Electrical Energy Source Identification Labels: On each unit of equipment, install a unique source and circuit designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manuals. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system.

1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 3/8-inch high letters on 3/4-inch high label; where 2 lines of text are required, use labels 1.5 inches high.
   b. Outlet, Device, Pull and Junction Boxes: Apply source and circuit to back of device box cover and to front of pull and junction box covers with indelible ink.
2. Equipment to be Labeled:
   a. Panelboards.
   b. Emergency system boxes and enclosures.
   c. Disconnect switches.
   d. Enclosed circuit breakers.
   e. Motor starters.
   f. Contactors.
   g. Fire alarm control panel and power supplies.
   h. Security and intrusion-detection control panels.
   i. Uninterruptible power supply equipment.
   j. Wiring devices boxes.
   k. Junction and pull boxes.
   l. Electrical devices (receptacles, switches etc.) shall be labeled with circuit number inside the coverplate of the device.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Time Switches.

B. Indoor Photoelectric Switches.

C. Indoor Occupancy Sensors.

D. Lighting Contactors.

E. Emergency Shunt Relay.

F. Conductors and Cables.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1. Includes finish requirements for wall controls specified in this section.
2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

F. Section 265100 - Interior Lighting.

G. Section 265600 - Exterior Lighting.

H. Section 260936 - Stand Alone Lighting Contr

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

E. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

F. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

1.05 ACTION SUBMITTALS

A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

C. Field Quality Control Reports.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 OPERATION AND MAINTENANCE MATERIALS

A. Operation and Maintenance Data: Include detailed information on device programming and setup.

1.07 WARRANTIES

A. Provide five year manufacturer warranty for all occupancy sensors.

B. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

C. Provide two year manufacturer warranty for all daylighting controls.

1.08 RECORD DOCUMENTS

A. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.09 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.10 COORDINATION

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.

B. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.

C. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.

D. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.

1. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.11 DELIVERY, STORAGE AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.12 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

PART 2 PRODUCTS

2.01 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Intermatic ET70415CR or a comparable product by one of the following:

1. Leviton Mfg. Company Inc.
2. Paragon Electric Co.; Invensys Climate Controls.
3. Square D; Schneider Electric.
4. TORK.

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: SPDT.
2. Contact Rating: 20-A ballast load, 120-277-V ac.
3. Programs: 4 channels; each channel shall be individually programmable with a minimum of 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays. Program data shall be stored with non-volatile memory for the life of the time switch without the need for battery back-up.
4. Astronomic Time: All channels.
5. Battery Backup: For schedules and time clock.

2.02 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. Eaton Electrical Inc; Cutler-Hammer Products.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Cooper Controls, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Watt Stopper (The).

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photo resistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70
3. Light-Level Monitoring Range: 10 to 200 fc , with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with dead band adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

C. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A . Sensor shall be powered from the relay unit.

2.03 INDOOR OCCUPANCY SENSORS

A. Wall mounted occupancy sensor single switch type.

B. Wall or ceiling mounted dual, (passive infrared with ultrasonic or microphonic) or single technology as indicated below.

C. Infrared Wall-Switch Sensors

1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

D. Dual-Technology Ceiling or Wall Mounted Sensors

1. Description: Combination passive-infrared and ultrasonic type, adjustable time delay up to 30 minutes, adjustable sensitivity, 90-degree field of view, with single-pole, double-throw isolated relay, and with a minimum coverage area of 2000 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

E. Dual-Technology Ceiling or Wall Mounted Sensors

1. Description: Combination passive-infrared and ultrasonic type, adjustable time delay up to 15 minutes, adjustable ultrasonic sensitivity, 360-degree field of view, with an integral single-pole, double-throw isolated relay, and with a minimum coverage area of 1000 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

F. Infrared Small-Room Ceiling-Mounted Sensors

1. Description: Passive-infrared type, adjustable time delay up to 15 minutes, 90-degree field of view, with a minimum coverage area of 300 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

G. Infrared Medium-Room Ceiling-Mounted Sensors

1. Description: Passive-infrared type, adjustable time delay up to 15 minutes, 360-degree field of view, an integral single-pole, double-throw isolated relay, and with a minimum coverage area of 500 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. .Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

H. Infrared Large-Room Ceiling or Wall Mounted Sensors

1. Description: Passive-infrared type, adjustable time delay up to 30 minutes, adjustable sensitivity, 90-degree field of view, an integral single-pole, double-throw isolated relay, and with a minimum coverage area of 2000 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. .Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

I. Ultrasonic Small-Room Ceiling-Mounted Sensors

1. Description: Ultrasonic type, adjustable time delay up to 15 minutes, adjustable sensitivity, 180-degree field of view, an integral single-pole, double-throw isolated relay, and with a minimum coverage area of 600 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. .Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

J. Ultrasonic Medium-Room Ceiling-Mounted Sensors

1. Description: Ultrasonic type, adjustable time delay up to 15 minutes, adjustable sensitivity, 360-degree field of view, an integral single-pole, double-throw isolated relay, and with a minimum coverage area of 1100 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. .Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

K. Ultrasonic Large-Room Ceiling-Mounted Sensors

1. Description: Ultrasonic type, adjustable time delay up to 15 minutes, adjustable sensitivity, 360-degree field of view, an integral single-pole, double-throw isolated relay, and with a minimum coverage area of 2200 sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. .Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

L. Ultrasonic Corridor-Configuration Ceiling-Mounted Sensors

1. Description: Ultrasonic type, adjustable time delay up to 15 minutes, adjustable sensitivity, 360-degree field of view over 90 linear feet, an integral single-pole, double-throw isolated relay, and with a minimum coverage pattern of 10’x90’ sq. ft. Provide power packs or accessories as necessary to control 120V or 277V rated loads. Provide an additional single-pole, double-throw isolated relay for HVAC control system interface.

2.04 LIGHTING CONTACTORS

A. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508 UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA EN 10250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.05 EMERGENCY SHUNT RELAY

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. The Bodine Company, Inc.
2. Lighting Control and Design, Inc.
3. LVS, Inc.
4. Nine 24, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. UL 924 Standard for Emergency Lighting and Power Equipment
2. Coil Rating: 120 or 277V as required.
3. Automatic maximum illumination function. Unit shall signal the lighting control system dimmer driver to full output upon switchover to the alternate source during loss of normal power.
4. Emergency lighting test function shall be provided to maintain the selected light fixtures energized for 5 seconds after the manual or automatic light switch disconnects the light fixtures on the same switch leg.

2.06 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.01 SENSOR BASIS-OF-DESIGN

A. The Drawings show potentially suitable occupancy sensor types and locations. The manufacturer shall examine the plan spaces and provide the most suitable occupancy sensor(s) for each space based on room and furniture configurations and other room conditions. Occupancy sensor location plan drawings shall be required as submittals for approval by the Architect/Engineer. The Contractor’s Bid shall include all extra wiring and components for a fully functional occupancy control system; extra components may include power packs, slave packs, form C packs, relays, switch packs, and mounting brackets.

3.02 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 95 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions. Adjust sensor sensitivities and timers to optimize performance.

B. Occupancy sensors shall be located to:

1. Be able to detect minor movement,
2. Not operate nuisance switching due to ambient airflow or passerby traffic.
3. Minimize damage from room function. Provide a protective wire cage on sensors installed in gymnasiums and locker rooms.

3.03 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.04 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1 . Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.05 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.06 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.08 START UP SERVICE

3.09 DEMONSTRATION AND TRAINING

END OF SECTION 260923

SECTION 260936 - STANDALONE LIGHTING CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimming Controls

B. Wall-Box Multiscene Dimming Controls

C. Multipreset Modular Dimming Controls

D. Conductors and Cables

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

C. All Lighting Control System (LCS) projects shall meet the energy and control requirements outlined in the most current edition of the Energy Conservation Construction Code of New York State. For LEED projects, comply with the requirements of Credit EQc6.1: Controllability of Systems – Lighting and requirements of Credit EQc6.1: Controllability of Systems – Lighting and coordinate the design of lighting controls as required for Credit EAp2 Minimum Energy Performance and EAc1 Optimize Energy Performance.

1.03 RELATED REQUIREMENTS

A. Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1.04 REFERENCE STANDARDS

A. IEEE C62.41.1 - IEEE Standard Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Reaffirmed 2008).

B. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

F. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

1.05 ABBREVIATIONS AND ACRONYMS

A. SCR: Silicon-controlled rectifier.

1.06 DEFINITIONS

A. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.

B. Low Voltage: As defined in NFPA 70, the term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.

C. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.

D. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

E. Standalone Lighting Control System: A standalone lighting control system is defined by this standard as a system of wired or wireless, line or low-voltage, or battery-operated components that control the lighting within a room or space and are not connected or interfaced with any other rooms or spaces. All software and logic are contained within the lighting control devices installed within the room or space.

F. Building Automation Control System (BACS) Lighting Control System: A BACS lighting control system is defined by this standard as a system of wired components that are connected directly to the inputs/outputs of the BACS equipment controllers and where the BACS software and hardware performs all lighting control functions.

G. Networked Lighting Control System: A networked lighting control system is defined by this standard as any lighting control system that utilizes hardware (hubs, nodes, servers, gateways, bridges, etc.) or software (including software that requires an initial or recurring subscription or license fee) to connect, control, adjust, program, integrate, monitor, or manage multiple lighting control devices over a network (IP, proprietary, cloud based, public or private, and wired or wirelessnetworks). BACnet shall not be specified to integrate or interface any lighting control system to the BACS. The University does not monitor or remotely manage lighting control systems.

1.07 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
2. Device plates and plate color and material.

3. Ballasts and lamp combinations compatible with dimmers.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring. Include all components provided as part of the lighting control system for each space.

C. Samples for Initial Selection: For master- and remote-control stations, and faceplates with factory-applied color finishes and technical features.

D. Samples for Verification: For master- and remote-control stations, and faceplates with factory-applied color finishes and technical features.

E. Field quality-control reports.

1.08 SUMMARY OF DESIGN INTENT

A. New Construction and Renovations: The design professional shall specify standalone lighting control systems consisting of line-voltage or low-voltage lighting controls, light reduction and daylight responsive sensors (standalone sensors or sensors integrated into luminaires), and power and auxiliary relay packs.

1. Renovations shall utilize wired or wireless (or a combination of wired and wireless) lighting controls.

1.09 PRE-INSTALLATION CONFERENCE

A. Contractor to schedule and conduct a Pre-Installation Conference to review the LCS in accordance with the project General Requirements, Section 013119 – Project Meetings.

1.10 SUBMITTAL REVIEW

A. The LCS submittal package shall be reviewed by Cornell Stakeholders and the Commissioning Agent prior to acceptance.

B. The following list represents the Cornell stakeholders that shall be included in all meetings and decisions regarding the design of a lighting control system:

1. Project Manager
2. Facility Director
3. Building Coordinator
4. Energy & Sustainability (E&S)
5. Facilities Engineering (FE)
6. Facilities Management (FM)

1.11 TRAINING/REVIEW/SUPPORT

A. A requirement for the Contractor to schedule, conduct, and provide documentation of Owner training as follows:

1. Required attendees for training sessions.
2. Training shall be performed by factory trained and certified representatives; minimum number and hours shall be commensurate with the size and complexity of the LCS.
3. Post occupancy review: Six months after final acceptance, the manufacturer or manufacturer's representative shall meet with CU to review the function and operation of the LCS and provide all labor and materials to reprogram the LCS as required to meet the technical requirements.

1.12 RECORD DOCUMENTS

A. Closeout Documents shall include Operation and Maintenance Manuals and As-Built Drawings.

1.13 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

1.14 TESTING

A. Contractor scope of work associated with commissioning efforts:

1. The LCS manufacturer or the LCS manufacturer's certified representative shall conduct and certify the functional testing.
2. When light reduction and daylight responsive sensors, time switches, or programmable schedule controls, are specified, the following shall be confirmed:
   a. Placement, sensitivity, and time-out adjustments for light reduction sensors yield acceptable performance.
   b. Proper programming of time switches and programmable schedule controls.
   c. Daylight responsive sensors reduce artificial light levels

B. All lighting control equipment shall be commissioned to ensure that the hardware is calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's instructions.

C. The design professional shall coordinate with the Commissioning Agent to ensure that the construction documents include the scope of work associated with the commissioning efforts. Refer to the latest edition of the IESNA LP-8-20 standard for additional information

1.15 COORDINATION

A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions. Include coordination with the following:

1. Division 26 Section "Lighting Control Devices."

1.16 SUMMARY DESCRIPTION

A. Section Includes:

1. Dimming Controls
2. Wall-box multiscene dimming controls.
3. Multipreset modular dimming controls.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

B. BACS Lighting Control: Lighting control equipment compatible with ALC or Alerton.

1. Approved Manufacturers:
   a. Legrand Wattstopper
   b. Lutron
   c. Leviton

C. Standalone Lighting Controls:

1. Approved Manufacturers:
   a. Acuity Sensorswitch
   b. Lutron Graphik Eye
   c. Signify Philips
   d. Legrand Wattstopper
   e. Leviton
   f. Crestron
   g. Steinel
   h. Sensorworx
   i. NX Controls
   j. Intelligent Lighting Controls

D. Lutron Athena, Vive, Quantum, and Enterprise are not approved for use in any University owned or managed facilities.

2.02 GENERAL DIMMING DEVICE REQUIREMENTS

A. Compatibility:

1. Dimming control components shall be compatible with lighting fixtures, ballasts, and transformers.
2. Dimming control devices shall be compatible with lighting control system components specified in related sections for Addressable-Fixture Lighting Controls, Relay-Based Lighting Controls, and Lighting Control Devices.

B. Dimmers and Dimmer Modules: Comply with UL 508.

1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

C. Surge Protection: Withstand supply power surges without impairment to performance.

1. Panels: 6000 V, 3000 A, complying with IEEE C62.41.1 and IEEE C62.41.2.
2. Other System Devices: 6000 V, 3000 A, complying with IEEE C62.41.1 and IEEE C62.41.2.

D. Off Control Position: User-selected off position of any control point shall disconnect the load from line supply.

2.03 SYSTEM DESCRIPTION

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. Comply with NFPA 70.

2.04 WALL-BOX MULTISCENE DIMMING CONTROLS

A. Description: Factory-fabricated equipment providing manual dimming consisting of a wall-box-mounted master controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in multigang wall box under a single wall plate. Each zone shall be adjustable to indicated number of scenes, which shall reside in the memory of zone controller.

B. Each zone shall be configurable to control the following loads:

1. LED lamps or modules
2. Low-voltage incandescent lamps, derived with magnetic transformers.
3. Non-dim, on-off switching only.

C. Dimmers: Regulate voltages to maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent rms.

D. Memory:

1. Retain preset scenes and fade rates through momentary (up to 3-second) power interruptions.
2. Retain preset scenes through power failures for at least seven days.

E. Device Plates: Style, material, and color shall comply with Section 262726 "Wiring Devices.Master-control cover plate shall be one piece.

F. Master controller shall include the following:

1. Cover-mounted switches, including master off, all bright, and selectors for each scene.
2. Cover-mounted LED indicator lights, one associated with each scene switch, and one for the master off switch.
3. Concealed switches and indicators for specified function.
4. A raise/lower switch for each zone for temporary adjustments of the zone, without altering scene values stored in memory.
5. Fade time indicated by digital display for current scene while fading.
6. Cover-mounted infrared receiver.

G. Infrared Transmitters: Wireless remote control for recalling each of the presets. Operate up to 50 feet (15 m) within line of sight of the master controller.

2.05 MULTIPRESET MODULAR DIMMING CONTROLS

A. Description: Factory-fabricated equipment providing manual dimming consisting of. the following:

1. Master controller.
2. Dimmer panels, and indicated number of zone stations.
3. Controls and dimmers shall be integrated for mounting in a multigang wall box under a single wall plate.
4. Each zone shall be adjustable to indicated number of scenes, which shall reside in the memory of zone controller.

B. Each zone shall be configurable to control the following loads:

1. LED Lamps or modules
2. Low-voltage incandescent lamps, derived with magnetic transformers.
3. Non-dim, on-off switching only.
4. Cold Cathode or Neon

C. Dimmers: Regulate voltages to maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent rms.

D. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.

E. Device Plates: Style, material, and color shall comply with Section 262726 "Wiring Devices. Master-control cover plate shall be one piece.

F. Master controller shall include the following:

1. Wall-box style, single coverplate supplied by manufacturer.
2. Cover-mounted controls, including master off, and selectors for each scene.
3. Cover-mounted LED indicator lights, one associated with each scene switch, and one for the master off switch.
4. Concealed switches and indicators for specified function.
5. A raise/lower switch for each zone for temporary adjustments of the zone, without altering scene values stored in memory.
6. Fade time indicated by digital display for current scene while fading.
7. Cover-mounted infrared receiver

G. Remote-Control Stations:

1. Numbered push buttons to select scenes.
2. Off switch to turn master station off. Operating the off switch at any remote station shall automatically turn on selected housekeeping lighting.
3. On switch turns all scenes of master station to full bright.
4. Control Wiring: NFPA 70, Class 2.
5. Mounting: Single flush wall box with manufacturer's standard faceplate.

H. Infrared Remote-Control Station: Same functions as for standard remote-control station except that functions are input by a hand-held infrared transmitter. Operate up to 50 feet (15 m) within line of sight of the master controller.

I. Dimmer Panels: Modular, plug-in type, complying with UL 508.

1. Integrated Short-Circuit Rating: 10 kA for 120 V.
2. Dimmers:
   a. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
   b. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
   c. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
   d. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in rms voltage.

J. Circuit Breakers: Complying with UL 489 and classified as switch duty (SWD).

2.06 CONDUCTORS AND CABLES

A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power onductors and Cables."

PART 3 EXECUTION

3.01 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.02 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identifying components and power and control wiring.

B. Label each dimmer module with a unique designation.

C. Label each scene control button with approved scene description.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
    a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

D. Remove and replace malfunctioning modular dimming control components and retest as specified above.

E. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

F. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.04 START UP SERVICE

3.05 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls. Laptop portable computer shall be used in training.

B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system.

END OF SECTION 260936

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Straight Blade Receptacles

B. GFCI Receptacles

C. Hazardous (Classified) Location Receptacles

D. Twist Locking Receptacles

E. Pendant Cord-Connector Devices

F. Cord and Plug Sets

G. Snap Switches

H. Wall-Box Dimmers

I. UL 1472 Solid-State Dimming Controls

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

C. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

F. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

G. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

H. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ABBREVIATIONS AND ACRONYMS

1.06 DEFINITIONS

1.07 ACTION SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

B. Samples: One for each type and color of device and wall plate specified.

C. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.08 OPERATION AND MAINTENANCE MATERIALS

A. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.
3. Surge Protection Receptacles: Include information on status indicators.

1.09 RECORD DOCUMENTS

A. Project Record Documents: Record actual installed locations of wiring devices.

1.10 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.11 TESTING

1.12 MOCK-UPS AND SAMPLES

1.13 COORDINATION

A. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

B. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

C. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

D. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

E. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

F. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.14 DELIVERY, STORAGE AND HANDLING

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

1.15 EXTRA MATERIALS

A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
3. Extra Keys for Locking Switches: Two of each type.
4. Extra Surge Protection Receptacles: Two of each type.
5. Extra Wall Plates: One of each style, size, and finish.
6. Extra Flush Floor Service Fittings: Two of each type.

1.16 SUMMARY DESCRIPTION

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Arrow Hart Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Legrand Pass & Seymour.

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. For all 120V straight blade occupancy controlled receptacles include the notation "CONTROLLED" and the controlled receptacle marking per NEC 406.11(D).

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper; 5351 (single), 5352 (duplex).
   b. Hubbell; HBL5351 (single), HBL5352 (duplex).
   c. Leviton; 5351 (single), 5352 (duplex).
   d. Legrand Pass & Seymour; 5361 (single), 5362 (duplex).

B. USB Combination Receptacle: Provide duplex receptacle as specified above, along with two integral USB charging ports. Each USB port shall be rated 2.1A minimum at 5VDC, and shall be compatible with USB 2.0 & 3.0 devices.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper TR7746
   b. Legrand Pass & Seymour TR5362USB
   c. Leviton T5632-W

2.03 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience REceptacles, 125 V, 20 A

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper; GF20.
   b. Legrand Pass & Seymour; 2095.

2.04 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010 UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper Crouse-Hinds.
   b. EGS/Appleton Electric.
   c. Killark; a division of Hubbell, Inc.
   d. Legrand Pass & Seymour

2.05 TWIST LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper; CWL520R.
2. Hubbell; HBL2310.
   a. Leviton; 2310.
   b. Legrand Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper; IGL520R
   b. Hubbell; IG2310.
   c. Leviton; 2310-IG.
   d. Legrand Pass & Seymour; IGL520-R
2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.06 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R (or as indicated on Drawings), heavy-duty grade.

1. Products: Subject to compliance with requirements, provide one of the following:
2. Arrow Hart Cooper; CWL520P, CWL520C with I-Grip Strain Relief
3. Description
   a. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.

b. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.07 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.08 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper; AH1221 (single pole), AH1222 (two pole), AH1223 (three way), AH1224 (four way).
   b. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   d. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).
2. Description: Industrial extra heavy-duty specification grade switches.

C. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Arrow Hart Cooper; 1995.
   b. Hubbell; HBL1557.
   c. Leviton; 1257.
   d. Pass & Seymour; 1251.
      1) Wiring Devices Connected to Normal Power System: Black, unless otherwise indicated or required by NFPA 70 or device listing.
         (a) NFPA 70 National Electrical Code
      2) Wiring Devices Connected to Emergency Power System: Red.
      3) Isolated-Ground Receptacles: Ivory with orange triangle designation on face.
      4) Wiring Devices Connected to Technology Grade Panelboards: Black unless otherwise indicated or required by NFPA 70 or device listing.

5) NFPA 70 National Electrical Code

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles and switches: Identify panelboard and circuit number from which served. Use durable wire marker on the back (inside) of the cover plate.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value above five percent is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 265100 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting Fixtures and Components, General Requirements.

B. Wiring.

C. Led Sources.

D. Led Power Supplies.

E. Lamps.

F. Emergency Lighting Units.

G. Emergency Battery Packs.

H. Emergency Lighting with Integral Power Transfer Device.

I. Exit Signs.

J. Luminaire Support Components.

1.02 GENERAL REFERENCES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

B. Common Electrical Requirements in Section 260000 apply to this Section. Requirements noted in this Section are supplemental to the requirements of these General References.

1.03 RELATED REQUIREMENTS

A. Section 260533.16 - Boxes for Electrical Systems.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.04 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.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. IEEE 1789 - IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers; 2015.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.05 ABBREVIATIONS AND ACRONYMS

1.06 DEFINITIONS

1.07 ACTION SUBMITTALS

A. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life.
   b. Include IES test report upon request.
2. Provide electronic files of photometric data certified by an independent testing agency in
3. LED Retrofit Luminaire Conversion Kits: Include list of compatible luminaires and/or criteria for compatibility.

C. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.

E. Field quality control reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.08 OPERATION AND MAINTENANCE MATERIALS

A. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.09 WARRANTIES

A. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

B. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

C. Provide 3-year manufacturer warranty for LED retrofit luminaire conversion kits.

1.10 RECORD DOCUMENTS

A. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.11 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.12 COORDINATION

A. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

B. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

C. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

D. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.13 DELIVERY, STORAGE AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.14 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings, or approved alternate.

2.02 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 41 to 104 deg F.

1. Relative Humidity: Zero to 95 percent.

2.03 LIGHTING FIXTURES AND COMPONENTS, GENERAL 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. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

C. LED Fixtures: Comply with UL 1598.

D. Metal Finishes: Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved samples and if they can be and are assembled or installed to minimize contrast.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components:

1. Steel, minimum 22 gauge for troffers, unless otherwise indicated.
2. Form and support to prevent warping and sagging.

G. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

H. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/A240M.

I. Galvanized Steel: ASTM A653/A653M.

J. Aluminum: ASTM B209/B209M.

K. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools.
2. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
3. Spring loaded cam latches.
4. Designed and fabricated to include reinforcing to prevent warping.

L. Finish ferrous mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

M. For vapor tight installations, painted finishes of fixtures and accessories shall be weather resistant enamel using proper primers or galvanized and bonderized epoxy, so that the entire assembly is completely corrosion resistant for the service intended. Where aluminum parts come into contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

N. Fixtures shall be free of light leaks and designed to provide sufficient ventilation of electronic parts to provide the photometric performance required. Drivers shall be adequately vented.

O. Fixtures shall be free of light leaks and designed to provide sufficient ventilation of electronic parts to provide the photometric performance required. Drivers shall be adequately vented.

P. All sheet metal work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. Intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly. Finish exposed edges so no sharp or ragged edges are exposed. All miters shall be in accurate alignment with abutting intersecting members.

Q. For adjustable fixtures, provide positive locking devices to fix aiming angle. Fixture shall be capable of being relamped without adjusting aiming angle.

R. Fixtures recessed in suspended ceilings where the space above the ceiling is either an air supply or return plenum shall conform to NEC Article 300-22.

S. Safety: Provide safety devices for removable fixture elements (cones, reflectors, lenses, etc.) to support removable elements when not in normal operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance, maintenance or the seating of any fixture element, and not be visible during normal fixture operation.

T. Fixture Finish: Visible surfaces. Powder coated paint or natural aluminum as specified in Light Fixture Schedule. Color and finish as selected by architect. Concealed parts, (lamp holders, yokes, brackets, etc.) matte black.

U. Off-state Power: Luminaires shall not draw power in the off state. Exception: Luminaires with integral occupancy, motion, photo-controls or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

V. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
    b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.

2.04 WIRING

A. Flexible cord wiring between fixture components or to electrical receptacle and not in wireways shall have a minimum temperature rating of 221 deg F.

B. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.

C. No internal wiring shall be visible at normal viewing angles, i.e. above 45° from vertical.

2.05 LED SOURCES

A. Comply with ANSI/UL 1993-2009 AND ANSI/UL 8750-2008, “Light Emitting Diode (LED) for Use in Lighting Products”. Photometric testing data shall be in accordance with IESNA LM-79. Lumen maintenance depreciation measurements shall be in accordance with IESNA LM-80, while long term lumen maintenance estimations shall be in accordance with IESNA TM-21.

B. LED sources shall have a minimum CRI of 90 unless otherwise specified in the Light Fixture Schedule.

C. LED sources shall have a color temperature as indicated on Drawings. Color temperature variation shall not exceed +/- 100 degrees Kelvin at installation, +/- 200 degrees Kelvin over the life of the luminaire.

D. Rated lamp life of at least 70% of initial lumens, when installed for a minimum of 50,000 hours, or as indicated on Drawings.

E. Luminaires shall be dimmable from 100% to 5% of maximum lighting output, or as indicated on Drawings.

F. LED sources shall start and operate in 0°F to 40°F ambient.

G. LED sources shall be designed for ease of component replacement and end-of-life disassembly from room side. All internal components shall be assembled and pre-wired using modular electrical connections.

H. LED sources shall be RoHS compliant (Restriction of Hazardous Substances).

I. LED sources shall be binned to a 3 step MacAdam ellipse (SDCM: Standard Deviation Color Matching) of the 3500K Planckian Locus to ensure color consistency.

J. LED products must have a minimum 5 year warranty for replacement of all components, including LED board or driver.

K. LED light engine array assembly shall be a field replaceable component.

L. LED light engine shall be seperated from the driver/power supply and it shall be colled by a suitable heat sink.

M. Nominal Operating Voltage: On a per fixture basis, refer to luminaire schedule for operating voltage.

2.06 LED POWER SUPPLIES

A. Minimum power factor 90%.

B. Minimum operating temperature of -4 deg F.

C. Output operating frequency shall be minimum 120 Hz.

D. Power supply shall meet FCC requirements for non-consumer use.

E. Sound rating: Class A.

F. Power supply shall comply with IEEE C.62.41-1991, Class A operation.

G. Power supply shall comply with IIEEE 1789-2015,

1. Below 90 Hz, Modulation (%) is less than 0.01×frequency.
2. Between 90 Hz and 3000 Hz, Modulation (%) is below 0.0333×frequency.

3. Above 3000 Hz, there is no restriction on Modulation (%).

H. Demonstrate conformance with product literature

I. Present tests that demonstrate driver performance at full dimming range, from 0.1% to 100% in 10% increments.

J. Comply with NEC-70 with respect to the installation of Class-2, limited energy circuit wiring.

2.07 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit Voltage drops to 80 percent of nominal Voltage or below. Lamp automatically disconnects from battery when Voltage approaches deep-discharge level. When normal Voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Where indicated on Drawings, provide heavy-chrome-plated wire guard protects lamp heads or fixtures.

2.08 EMERGENCY BATTERY PACKS

A. Where fixtures are indicated or specified to have self-contained battery backup:

1. Provide battery pack(s) with 1100 lumen output or as indicated on Drawings. Unit shall have high temperature nickel cadmium battery, automatic transfer switch, battery charger high frequency inverter, installed test/charging indicator and switch, dual voltage, and be UL listed to standard 924. Provide normal switching connection where indicated.

B. Testing: Apply power for 24 hours, disconnect power observe, measure and record light output for specified 90-minute period. Continue to run on battery until automatic low battery cut-off circuit disconnects battery. Restore normal power and verify battery returns to charging mode.

C. Warranty: Entire unit shall be warranted for 5 years; battery shall have 15-year life expectancy with 5-year full warranty and 7 additional years prorated warranty. Full warranty to cover labor and materials without charge. Prorated warranty to cover material only.

2.09 EMERGENCY LIGHTING WITH INTEGRAL POWER TRANSFER DEVICE

A. Directly controlled luminaires that respond to external controls and are used to provide emergency lighting by responding to bypass normal circuits in the event of loss of normal power, shall be UL 924 listed.

2.10 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or equal alternate for review and approval during submittal review process.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.Operation: Relay automatically energizes lamp from battery when circuit Voltage drops to 80 percent of nominal Voltage or below. When normal Voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.Universal mounting unless a specific mounting is indicated.
    c. Operation: Relay automatically energizes lamp from battery when circuit Voltage drops to 80 percent of nominal Voltage or below. When normal Voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Universal mounting unless a specific mounting is indicated.

2.11 LUMINAIRE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2 inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2 inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16 inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the 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.

3.02 TEMPORARY LIGHTING

A. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, relamp and reinstall.

3.03 INSTALLATION

A. Provide mounting accessories and trims for wall and ceiling construction types shown in Finish Schedule and on Drawings.

B. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls, unless otherwise indicated.
2. For fixtures with replaceable lamps, install lamps in each luminaire.

C. Adjust aimable lighting fixtures to provide required light intensities. Coordinate aiming requirements with Owner, Architect, and Lighting Designer.

D. Verify weight and mounting method of fixtures and provide suitable supports. Fixture mounting assemblies to comply with local seismic codes and regulations.

E. Provide support for luminaire without causing deflection of ceiling or wall. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

F. Refer to architectural reflected ceiling plans for coordination of lighting fixture locations with mechanical and fire safety equipment. Where conflicts occur, consult with Architect prior to installing any of the systems.

G. For fire rated ceilings and walls, provide rated enclosure for recessed light fixture, or consult with Architect and Lighting Designer to specify fixture suitable for use in rated ceiling or wall.

H. Install fixtures with vent holes free of air blocking obstacles.

I. Adjust aperture rings on all recessed fixtures to be flush with the finished ceiling.

J. Adjust variable position lampholders for proper lamp position prior to fixture installation.

K. Blemished, damaged or unsatisfactory fixtures or accessories to be replaced with new.

L. In accessible suspended ceilings, provide 72" flexible conduit wiring connection (flexible tubing not permitted) from a rigidly supported junction box.

M. All finishes shall be unmarred upon project completion. Repair or replace damaged finishes.

N. Replace all burned out or inoperative lamps and LED boards at the end of the construction prior to Owner occupancy. LED boards with visibly different color LEDs will be considered inoperative and require replacement.

O. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Fixtures with Same Dimensions As Ceiling Grid:
    a. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
    b. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independent of acoustical panel with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
3. Install at least one independent support system, rod or wire, from structure to a tab on lighting fixture. Support system shall have breaking strength of the weight of fixture at a safety factor of 3.

P. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end. Laser sight to assure fixtures are straight when sighting from end to end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

Q. Surface Mounted Type:

1. Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
2. Continuous Runs of Fixtures: Laser sight to assure fixtures are straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections.

R. Wall-Mounted Luminaire Support

1. Attached to structural members in walls or attached to a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

S. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

T. Clean lamps, lenses, and reflectors of all dirt, debris, paint, and finger prints prior to Substantial Completion of Work.

U. Lamps and drivers shall be in working order at the time of Substantial Completion of Work.

V. Remote Mounting of drivers : Distance between the driver and the fixture shall not exceed that recommended by driver manufacturer. Verify with manufacturers for maximum distances.

W. Provide remote UL924 control device where required.

3.04 DIFFUSERS AND ENCLOSURES

A. Remove protective plastic covers from lighting fixture diffusers only after construction work, painting and clean-up are completed. Remove all dirty lamps, reflectors and diffusers; clean and reinstall. When cleaning "Alzak" reflectors, use a manufacturer recommended cleaning solution. Reflectors damaged or impregnated with fingerprints shall be replaced at no cost to Owner.

B. For LED fixtures, whether surface mounted or recessed, remove all construction dirt and dust from heat sink fins to ensure proper dissipation of heat.

3.05 ADJUSTMENT OF LIGHT FIXTURES

A. Focus all adjustable light fixtures under the direction of the Lighting Designer during a scheduled period of time prior to the completion of the project, after normal business hours if required. Include all equipment and personnel expenses (including overtime) required for adjustment.

B. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

C. Adjust aimable luminaires in the presence of Lighting Designer.

3.06 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 for Emergency Lighting: Interrupt normal power supply to demonstrate proper operation. Verify transfer from normal power to emergency source (battery, generator, etc) and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

3.07 LAMP AND BALLAST DISPOSAL

A. Dispose of waste lamps and ballasts in accordance with local, state and federal regulations, unless requested by owner to retain device.

END OF SECTION 265100

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. Section 270500 – Common Work

C. Section 270526 – Grounding and b

D. Section 270528 – Pathways for Communication Systems

E. Section 270533 – Conduits and Backboxes for Communications Systems

F. Section 270536 – Cable Trays For Communications Systems

G. Section 270553 – Identification for Communications Systems

H. Section 271100 - Communications Equipment Room Fittings

I. Section 271116 - Communications Cabinets, Racks, Frames & Enclosures

J. Section 271119 - Communications Termination Blocks and Patch Panel

K. Section 271300 - Communications Backbone Cabling

L. Section 271500 - Communications Horizontal Cabling

M. Cornell Design & Construction Standards, Div. 27

N. Other References

1.02 SUMMARY

A. This section includes general requirements for all Division 27 work and is supplemental and in addition to the requirements of Division 1.

B. It is the intention of this Division of the Specifications and the Contract Drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and fully operational condition all equipment, materials, devices and necessary appurtenances to provide a complete communication system. Provide all materials, appliances and apparatus not specifically mentioned herein or shown on the drawings, but which are necessary to make a complete, fully operational installation of all communications systems shown on the contract drawings or described herein. Connect equipment and devices furnished and installed under other Divisions of this specification (or the Owner) under this Division.

C. Workmanship shall be of the best quality and competent and experienced technicians shall be employed and shall be under the supervision of a competent and experienced foreman.

D. The drawings and specifications are complementary and what is called for (or shown) in either is required to be provided as if called for in both. Where conflicting information occurs within the drawings and specifications or between the drawings and specifications, the more expensive alternative shall be used as a basis for bidding and construction.

E. See Division 01 for sequence of work.

1.03 WORK IN OTHER DIVISIONS

A. See all other specifications for other work which includes but is not limited to:

1. Cutting and Patching
2. Door Hardware
3. Electronic Safety and Security
4. Equipment Wiring
5. Interior Lighting
6. Lightning Protection Systems
7. Lighting Control Systems
8. Architectural Ceiling Systems
9. Fire Stopping
10. Mechanical Control Wiring
11. Mechanical Equipment
12. Painting, Refinishing and Finishes
13. Temporary Power

1.04 SUSTAINABLE CONSTRUCTION

A. Comply with Division 01 Sustainable Construction requirements.

B. LEED Compliance: This project was designed to LEED criteria. Contractor is required to:

C. Manufacturers must be members pricing of the "Green Supplier Network".

1.05 CODES, PERMITS, INSPECTION FEES

A. The following codes and standards are referenced in the Division 27 specifications. Perform all work and provide materials and equipment in accordance with the latest referenced codes and standards of the following organizations:

1. American National Standards Institute (ANSI)
2. National Electrical Manufacturer's Association (NEMA)
3. National Fire Protection Association (NFPA)

4. Underwriter's Laboratories (UL)
5. American Society for Testing and Materials (ASTM)
6. BICSI (A Telecommunications Association)
7. International Building Code (IBC)
8. Insulated Cable Engineers Association (ICEA)
9. Institute of Electrical and Electronic Engineers (IEEE)
10. Federal Communications Commission Rules and Regulations (FCC)
11. National Electrical Code (NFPA Article 70) (NEC)
12. National Electrical Safety Code (NESC)
13. Occupational Safety and Health Administration (OSHA)
14. Rural Utilities Service (RUS)
15. Telecommunications Industry Association (TIA)
16. Electronics Industry Alliance (EIA)
17. Uniform Building Code (UBC)
18. UL 2043 & UL 2239
19. NEMA VE1 & VE2
20. Chicago Electric Code

B. Install the communications systems based on the following:

1. National Electrical Code as adopted and amended by the Local Jurisdiction.
2. International Building Code as adopted and amended by the Local Jurisdiction.

C. Communications Specific:

1. ANSI/TIA-222-G – Structural Standards for Steel Antenna Towers and Antenna Supporting Structures.
2. ANSI/TIA-526-7-A: Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant.
3. ANSI/TIA-526-14-C: Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant.
4. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises.
5. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard
6. ANSI/TIA-568-2.D: Balanced Twisted Pair Telecommunications Cabling and Components Standards
7. ANSI/TIA-568.3-D: Optical Fiber Cabling Components Standard
8. ANSI/TIA-568.4-D: Broadband Coaxial Cabling and Components Standard.
9. ANSI/TIA-569-E: Telecommunications Pathways and Spaces
10. ANSI/TIA-606-C: Administration Standard for Telecommunications Infrastructure
11. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
12. ANSI/TIA-758-B: Customer-owned Outside Plant Telecommunications Infrastructure Standard

13. ANSI/TIA-862-B: Structured Cabling Infrastructure Standard for Intelligent Building Systems
14. ANSI/TIA-942-B: Telecommunications Infrastructure Standard for Data Centers
15. ANSI/TIA-1005 – Telecommunications Infrastructure Standard for Industrial Premises.
16. ANSI/TIA-1152 – Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
17. ANSI/TIA-1179-A: Healthcare Facility Telecommunications Infrastructure Standard
18. ANSI/TIA-4966: Telecommunications Infrastructure Standard for Educational Facilities
19. TIA: Technical Service Bulletins (TSBs) (TSBs) (related to the above ANSI/TIA standards)
20. ANSI/TIA TSB125 – Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning.
21. TIA TSB-140 – Additional Guidelines for Field Test Length, Loss and Polarity of Optical Fibers.
22. TIA TSB-155-A – Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBase-T.
23. TIA TSB-162 – Telecommunications Cabling Guidelines for Wireless Access Points.
24. TIA TSB-184 – Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling.
25. TIA-TSB-190 – Guidelines on Shared Pathways and Shared Sheaths.
26. IEEE 802.11 Wireless Local Area Network Standard, including the IEEE 802.11a, 802.11b, 802.11g, and 802.11n standards
27. BICSI: BICSI Customer Owned Outside Plant Design Manual, Latest Edition
28. BICSI: BICSI LAN and Internetworking Design Manual, Latest Edition
29. BICSI: BICSI Telecommunications Distribution Methods Manual, Latest Edition
30. BICSI: BICSI Telecommunications Cabling Installation Manual, Latest Edition
31. NEC: NFPA 70
32. FCC Part 68: Connection of Terminal Equipment to Telephone Network.
33. UL® for wiring: UL® Standard 910 “Test method for fire and smoke characteristics of cable used in air handling spaces.” Provide products that are UL® listed and labeled for such use. UL® testing bulletin. Underwriters Laboratories (UL®) cable certification and follow up program

D. The referenced codes and standards establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

E. Obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.06 DEFINITIONS / ACRONYMS / ABBREVIATIONS

A. AHJ Authority Having Jurisdiction

B.	ANSI	American National Standards Institute
C.	AWG	American Wire Gauge
D.	BICSI	Building Industry Consulting Service International
E.	CAT 6	Category 6 performance as defined by ANSI/TIA-568
F.	CAT 6A	Augmented Category 6 performance as defined by ANSI/TIA-568
G.	DC	Data Center
H.	EC	Electrical Contractor
I.	ER	Equipment Room
J.	EOR	Engineer of Record
K.	GC	General Contractor
L.	IEC	International Electrotechnical Commission
M.	ISO	International Organization for Standardization
N.	MM	Multimode (Fiber Optic Cable)
O.	NEC	National Electrical Code, National Fire Protection Association, Publication #70.
P.	NECA	National Electrical Contractors Association
Q.	NEMA	National Electrical Manufacturers Association
R.	OM3	Optical Multimode 3 “laser optimized” performance as defined by ISO/IEC 11801 and ANSI/TIA-568
S.	OM4	Optical Multimode 4 “laser optimized” performance as defined by ISO/IEC 11801 and ANSI/TIA-568
T.	OS1	Optical Singlemode 1 performance as defined by ISO/IEC 11801 and ANSI/TIA-568
U.	OS2	Optical Singlemode 2 “low water peak” performance as defined by ISO/IEC 11801 and ANSI/TIA-568
V.	PBB	Primary Bonding Busbar
W.	RBB	Rack Bonding Busbar
X.	RCDD	Registered Communications Distribution Designer
Y.	SBB	Secondary Bonding Busbar

Z. SCS Structured Cabling System

AA. SM Singlemode (Fiber Optic Cable)

BB. STP Shielded Twisted Pair Cable

CC. TBB Telecommunications Bonding Backbone

DD. TBC Telecommunications Bonding Conductor

EE. TC Telecommunications Contractor

FF. TEBC Telecommunications Equipment Bonding Conductor

GG. TIA Telecommunications Industry Association

HH. TO Telecommunications Outlet

II. TR Telecommunication Room

JJ. UNO Unless Noted Otherwise

KK. UTP Unshielded Twisted Pair

LL. Accepted/Acceptable: Work or materials conforming with the intent of the project, and in general, conforming to the pertinent information in the Construction Documents

MM. Approved/Approval: The written approval of the Engineer.

NN. Accessible/Easy access: Access attained without requiring extensive removal of other materials to gain access.

OO. Accessible Ceiling: Acoustical tile hanging ceilings (“Hard-lid” ceilings [concealed spine or sheetrock/gypsum ceilings], even when provided with access panels, are not considered an Accessible Ceiling.)

PP. Agreement: The contractual agreement between the Owner and the Contractor.

QQ. Boxes: Outlet, Junction or Pull Boxes.

RR. Code: All applicable codes currently enforced at project location.

SS. Communications Infrastructure System: A communications Cabling System combined with a Communications Raceway System.

TT. Compression: Compressed using a leverage powered (hydraulic or equivalent) crimping tool.

UU. Concealed: Hidden from sight in interstitial building spaces, chases, furred spaces, shafts, crawl spaces, etc.

VV. Connection: All materials and labor required for equipment to be fully operational.

WW. Construction Documents: Collective term for the entire set of bound or unbound material describing the construction and services required, including all Drawings, Specifications, addenda issued prior to execution of the contract, and modifications issued after Execution of the Contract (such as change orders, construction change directives, supplemental instructions, etc.).

XX. Contrator (The): The party responsible for providing the system(s) as indicated herein.

YY. Drawings: The graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including (but not limited to) plans, elevations, sections, details, schedules and/or diagrams.

ZZ. Engineer/Consultant: The party responsible for producing the communications system(s) Construction Documents.

AAA. Exposed: Not concealed (see above) and not installed underground.

BBB. Exterior Location: Outside of or penetrating the outer surfaces of the building weather protective membrane.

CCC. Final Completion: The date when the Engineer confirms in writing that the Contractor has completed the work in accordance with the Construction Documents, including completion of all punch list items, cleanup work and delivery of all required guarantees, warranties, licenses, releases and other required deliverables.

DDD. Fully Operational: Tested, approved, and operating to the satisfaction of the AHJ, manufacturer and contract documents.

EEE. Furnish: To purchase, supply, and deliver to the project materials in new and operable condition, ready for installation.

FFF. Governing Authorities: Entities or their representatives charged with formation and/or enforcement of Governing Requirements, such as the Authority Having Jurisdiction (AHJ).

GGG. Install: To enter or attach permanently into the project and make fully operational.

HHH. Inside Plant (ISP): Infrastructure within a building; includes raceways, cabling, termination components and racks/cabinets

III. Noted: Shown or specified in the Contract Documents.

JJJ. Or Equal, Or Equivalent: Materials approved for use by the Engineer and which are dimensionally suitable and operationally identical to the specified item.

KKK. Outside Plant (OSP): Infrastructure exterior to a building.

LLL. Owner: The Owner and the Owner's designated representative(s).

MMM. Project (The): The total construction of which the Work performed under the Contract Documents may be the whole or a part, and which may include construction by the Owner and/or separate contractors.

NNN. Provide: Furnish and install.

OOO. Required: As required by code, AHJ, contract documents, or manufacturer for the particular installation to be fully operational.

PPP. Section: An individual section of the Specifications.

QQQ. Shown on Drawings: Noted, indicated, scheduled, detailed, or any other written reference made on the Drawings.

RRR. Specifications: The portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work and performance of related services.

SSS. Specification Section(s): One or more sections of the specifications.

TTT. Structured Cabling System (SCS): Alternative term for Communications Cabling System

UUU. Substantial Completion: The date when all work required by the Construction Documents shall be complete (subject to the final punch list to be prepared by the Engineer) and on which the applicable jurisdictional authorities have issued a temporary certification of occupancy.

VVV. Wiring: Raceway, conductors and connections.

WWW. Work (The): The construction and services required by the Contract Documents, whether completed or partially completed, and all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.07 COORDINATION

A. Coordinate work with that of the other Contractors and/or other trades doing work on the project. Examine all drawings and specifications of other trades for construction details and coordination. Make every reasonable effort to provide timely notice of work affecting other trades to prevent conflicts or interference as to space requirements, dimensions, openings, block-outs, sleeving or other matters which will cause delays or necessitate work-around methods.

B. Obtain submittals and shop drawings of all equipment with communications connections furnished under other divisions of the specification and by the Owner. Provide all wiring in accordance with specific equipment requirements. Immediately advise the Architect of any changes which may affect the contract price.

C. Special attention is called to the following items. Coordinate all conflicts prior to installation:

1. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all communications outlets and equipment are clear from and in proper relation to these items.
2. Location of cabinets, counters and doors so that communications outlets, and equipment are clear from and in proper relation to these items.

3. Recessing and concealing communications materials in CMU walls, concrete construction and precast construction.
4. In every telecommunication room with either active or passive equipment the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.
5. Review specifications for other Divisions of the work to determine where other Divisions are requiring communication connections. Verify provisions shown on contract drawings by examining shop drawing submittals of other Divisions prior to submission to the Owner. Do not proceed with ordering of supporting equipment, until characteristics are verified. Proceed with rough-in only after verification of shop drawings.

D. Digital format copies of bid drawings will be furnished to the successful bidder. Augment bid documents with additional information to ensure coordination between trades. Provide digital format communications systems drawings showing all ceiling devices, fixtures, raceways and cable tray locations and routing to mechanical contractor to be used for coordination drawings provided by mechanical contractor. Include dimensions and elevations of devices, fixtures, raceway and cable tray.

E. Furnish, install and place in satisfactory condition all raceways, boxes, conductors and connections and all other materials required for the communication systems shown or noted in the contract documents to be complete, fully operational and fully tested upon completion of the project. Raceways, boxes and ground connections are shown diagrammatically only and indicate the general character and approximate location. Where routings of major raceways and telecommunication pathways are indicated on plan sheets, the routing information supplements the information on diagrams. If no routing information is shown, route the systems in a manner that will coordinate with new and existing infrastructure and the work of other trades.

F. Consult the architectural drawings for the exact height and location of all communication equipment not specified herein or shown on the drawings. Make any minor changes (less than 6'-6" horizontal) in the location of the raceways, outlets, boxes, devices, wiring, etc., from those shown on the drawings without extra charge, where coordination requires or if so directed by the Architect before rough-in.

G. Provide inserts or sleeves for outlet boxes, conductors, cables and/or raceways as required. Coordinate the installation thereof with other trades.

H. The Contractor will not be paid for relocation of work, cuttings, patching and finishing required for work requiring reinstallation due to lack of coordination prior to installation.

1.08 WARRANTY

A. Contractor shall provide a warranty for the entire structured cabling system. The warranty shall be backed by the manufacturer of the cable and connectivity hardware. The warranty shall be valid for a period not less than 20 years and commence from the date of project substantial completion. The warranty shall cover, but not be limited to the following:

1. The SCS will be free from product defects in materials and workmanship

2. Will exceed applicable ANSI/TIA and ISO/IEC specifications in force at time of installation and will comply with design and performance requirements for recognized cabling media installed in the structured Cabling Link / Channel.
3. Will support any current or future application which is designed for transmission over a structured cabling system as defined by the above referenced standards in effect at the time of installation.

1.09 CONTRACTOR QUALIFICATIONS

A. The contractor selected for this project shall be certified by the manufacturer(s) of the products specified in this scope of work, adhere to the design engineering, installation and testing procedures and utilize the authorized manufacturer(s) components in completing this project.

B. Lead Installer shall have a minimum of 5-years of installation work experience running projects of similar size and scope.

C. The contractor shall be experienced in all aspects of the work required to complete this project and shall be required to demonstrate direct experience on recently installed systems of similar size and type.

D. The contractor shall own and maintain equipment and tools required for the installation and testing of the specified copper and optical fiber structured cabling systems. The TC shall also employ personnel who are adequately trained in the uses of required tools and equipment.

E. Contractor shall submit letters of certification from the proposed system manufacture indicating the contractor is an approved installer of proposed system and has had personnel trained in the proper installation and testing procedures of said system.

1.10 CORRECTION OF WORK

A. Within one year after the date of Substantial Completion of the work, the Contractor shall correct any work found to be not in conformance with the Contract Documents promptly after written notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive acceptance of the work under this Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

1.11 UNIT PRICES

A. The telecommunications contractor shall provide unit prices with proposal as indicated below. All unit costs shall include labor, material, coordination, supervision, project management, overhead, profit, miscellaneous support hardware, taxes, fees, shipping and handling.

B. Work area outlet unit costs are to include faceplate, outlets, cables, miscellaneous hardware and labor to pull, terminate (both ends) and test each typical location per telecommunications specifications. Identify number of cables and outlets at each typical location including category for each cable.

1. Typical work area outlet – wall. List by quantity of ports and cable category.

2. Typical work area outlet – furniture. List by quantity of ports and cable category.
3. Typical work area outlet – floor. List by quantity of ports and cable category.
4. Typical work area outlet – table. List by quantity of ports and cable category.
5. Wall Phone Outlet
6. CATV Outlet
7. Copper patch cords. List by category, color and length
8. Coaxial patch cord. List by category, color and length

C. Equipment room and telecommunications room unit costs shall include all labor and material. Termination of cables on the hardware is listed separately.

1. Jack panel, loaded. List each type by category and quantity of ports.
2. Patch panel, loaded. List each type by category and quantity of ports.
3. Equipment rack. List each type by dimensions, RMU and color.
4. Vertical cable manager. List each type by height, witch, sides (front/rear).
5. Horizontal cable manager. List each type by height, sides (front/rear).
6. Fiber adapter plates. List each by type and number of ports.
7. Fiber cassettes. List each by type and number of ports, including rear port(s).
8. 110 style termination block. List with pair quantity, clips and legs
9. Ground Equipment Rack within 50 Feet of TGB using No. 6 AWG
10. Ladder Rack. List each type by width, length, color.
11. Basket Tray. List each type by width, height, length, finish.

1.12 SUBMITTALS AND SHOP DRAWINGS

A. Submittals and Shop Drawings: Prepared under the direct supervision of a BICSI RCDD. Submit electronically in portable document format (PDF). Schedule so as not to delay construction schedule and no later than 60 days after award of contract Submit common brochure(s) with index and divider pages by specification section, containing all required catalog cuts. Allow two weeks for review for each submittal and resubmittal. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and resubmittal.

B. Product Submittals:

1. Indicate listing by UL or other approved testing agency.
2. Highlight electronically with yellow, blue, or red adequate information to demonstrate materials being submitted fully comply with contract documents.
3. Review and check all material prior to submittal and stamp "Reviewed and Approved".
4. Provide Manufacturer and/or lab certification that all product materials are PCB-free.

C. Shop drawings shall show:

1. Ratings of items and systems.
2. How the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.

3. System layout floor plans with complete device layout, point-to-point wiring connection between all components of the system, wire sizes and color coding.
4. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
5. Communications Rooms: Submit 1/2" = 1'-0" detail plans and wall elevations of each room showing actual size of equipment in place. Identify coordinating elements such as structural beams or mechanical systems. Submittals shall show coordination among all suppliers of equipment, including power components, fire alarm, racks, nurse call, public address, security, etc. Submit room layouts at same time as material submittals, and prior to installation of any equipment.

D. The Contractor agrees:

1. Submittals and shop drawings processed by the Architect are not change orders.
2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
4. To accept all responsibility for assuring that all materials furnished under this Division of the specifications meet, in full, all requirements of the contract documents.
5. To pay for Engineers review cost of submittal review beyond one resubmittal.

E. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for: Dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of this work with that of all other trades; performing this work in a safe and satisfactory manner.

F. Submittals and shop drawings are required per the submittals schedule at the end of this Section.

1.13 PROJECT CLOSE-OUT

A. Coordinate with close-out provisions in Division 01 - General Requirements.

B. Request For Final Punchlist

1. To request a final low voltage punch list, forward a letter to Stantec, stating; "The communications work on this project is complete, all punch list items to date are complete, items a. - g. in the Punchlist Procure paragraph in Section 270500 - Common Work Results For Communications are complete and the project is ready for final punch list observation."
2. Project Punchlist Procedure: Perform the following procedures for project closeout of communications portions of work.
    a. Color code junction boxes per Section 260533 - Raceways and Boxes For Electrical Systems.
    b. Provide written warranty in O & M per the General Conditions of the Contract.

c. Furnish Record Drawings per this section. Obtain signature on Job Completion Form.
d. Furnish O & M Manuals per this section. Obtain signature on Job Completion Form.
e. Give instruction periods to Owner's personnel per this section. Obtain signature on Job Completion Form.
f. To request final acceptance of project, fill out Job Completion Form in this section and forward to Stantec. Note: If inspectors have not signed form, a copy of signed-off permits will suffice.
g. Include with Job Completion Form, a copy of the final punch list with the word "DONE", and the date and Contractor's initials after each item on the list.

1.14 COMMUNICATIONS EQUIPMENT OPERATION AND MAINTENANCE (O&M) MANUALS

A. Provide O&M manuals required in Division 01 - General Requirements plus one manual for Stantec for all equipment furnished under Division 27 - Communications of the specifications. Submit a preliminary copy, complete except for the bound cover, 60 days prior to completion of the project for checking and review. Deliver final bound electronic corrected copies as noted in Division 01 - General Requirements plus a copy to Stantec 20 days prior to scheduled instruction periods. Obtain a receipt for the manuals and forward a copy of the receipt to the Engineer with the Job Completion Form.

B. The information included must be the exact equipment installed. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

C. These O&M manuals shall contain all the information needed to operate and maintain all systems and equipment provided in the project. Present and arrange information in a logical manner for efficient use by the Owner's operating personnel. The information provided shall include but not be limited to the following:

1. Equipment manufacturer, make, model number, size, nameplate data, etc.
2. Description of system configuration and operation including component identification and interrelations. A master control schematic drawings(s) may be required for this purpose.
3. Dimensional and performance data for specific unit provided as appropriate.
4. Manufacturer's recommended operation instructions.
5. Complete parts list including reordering information, recommended spares and anticipated useful life (if appropriate). Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier not acceptable.
6. Shop drawings.
7. Wiring diagrams.
8. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation.
9. A complete list of local (nearest) manufacturer representative and distributor contacts for each type of equipment and manufacturer. Include name, company, address, phone, fax, e-mail address, and web site.
10. Cable test reports.

D. Furnish complete wiring diagrams for each system for the specific system installed under the contract. "Typical" line diagrams will not be acceptable unless revised to indicate the exact field installation.

E. Group the information contained in the manuals in an orderly arrangement by specification index. Provide a typewritten index and divider sheets between categories with identifying tabs. Bind the completed manuals with hard board covers not exceeding 5" thick. (Provide two or more volumes if required.) Signal and communication systems shall be in separate volumes. Imprint the Provide a coversheet with the name of the job, Owner, Architect, Engineer, Contractor and year of completion. Imprint the back edge Name the electronic file with the name of the job, Owner and year of completion. Hard board covers and literature contained may be held together with screw post binding. If required, hard copies shall be provided to the Owner at no additional cost to the Owner.

1.15 INSTRUCTION PERIODS

A. After substantial completion of the work and 20 days after the O&M manuals have been delivered to the Owner and after all tests and final inspection of the work by the Authority(s) Having Jurisdiction; demonstrateJurisdiction; demonstrate the systems and instruct the Owner's designated operating and maintenance personnel in the operation and maintenance of the various systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and supplierssuppliers' representatives when so specified. When more than one training session is specified, the second session shall be 30 to 90 days after the first as agreed to by the Owner.

B. Include in each instruction session an overview of the system, presentation of information in maintenance manuals with appropriate references to drawings. Conduct tours of the building areas with explanations of maintenance requirements, access methods, servicing and maintenance procedures, equipment cleaning procedures and adjustment locations.

C. Include the following scheduled instruction periods: 1st Session 2nd Session

1. Communications System [4] hours [4] hours

D. Provide one professionally produced digitally recorded recording of each training session in DVD format. Furnish two (2) copies to the Owner.

1.16 RECORD DRAWINGS

A. Continually record the actual low voltagecommunications system(s) installation on a set of prints or PDFs kept readily available at the project during construction. These prints shall be used for this purpose alone.

1. Mark record prints electronically or with red erasable pencil. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown.
2. Accurately locate with exact dimensions all underground and underslab raceways and stub-outs.

3. Note changes of directions and locations, by dimensions and elevations, as utilities are actually installed.
4. Include addenda items and revisions made during construction.
5. Erase conditions not constructed or "X-out" and annotate "not constructed" to clearly convey the actual "as constructed" condition.
6. Organize record drawings sheets in manageable sets, bind and print suitable titles, dates and other identification on the cover of each set.

B. Transmit the record drawing set to the Architect at the completion of the work. Final payment to the contractor will not be authorized until these prints have been submitted to and accepted by the Architect.

C. Transfer the changes marked up on the record prints into AutoCAD 2014 (or higher) at the completion of the work. Provide two (2) sets of prints, one set of fixed line reproducible drawings and one set of AutoCAD drawing files. Transmit drawings, CAD files and the record drawing mark-ups to the Architect. Final payment to the contractor will not be authorized until these documents have been submitted to and accepted by the Architect.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials and equipment installed shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled unless otherwise permitted by the Authority Having Jurisdiction (Inspector).

B. All materials to be new, free from defects and not less than quality herein specified. Materials shall be designated to insureensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

C. Each type of materials furnished shall be of the same make, be standard products of manufacturers regularly engaged in production of such materials and be the manufacturer's latest standard design.

D. All materials, equipment and systems furnished that include provisions for storing, displaying, reporting, interfacing, inputting, or functioning using date specific information shall perform properly in all respects regardless of the century. Any interface to other new or existing materials, equipment or systems shall function properly and shall be century compliant, both in regard to information sent and received.

E. All materials shall be PCB-free.

F. All paint to be low-VOC.

2.02 SUBSTITUTION OF MATERIALS

A. No Substitute: Where a specified product is indicated "no substitute", it is the intent of this specification to require new materials to be compatible with the existing installation or as specifically requested by the owner. To this end certain materials and systems no substitution will be allowed.

B. Prior to Bid Opening: Acceptance of products other than those specified will be issued by addendum to the bid documents only after the following requirements are met and the proposed listed material is determined to meet or exceed the requirements:

1. Requests for listing to be original material, clearly indicating the product fully complies with contract documents and be neatly marked electronically with yellow felt tip markerhighlight to clearly define and describe the product for which listing is requested.
2. Samples shall be submitted if requested.
3. Requests shall be received 10 days prior to bid opening.
4. Requests containing insufficient information to confirm compliance with contract documents will not be considered.

C. After Award of Contract: Substitution of products will be considered after award of contract only under the following conditions:

1. The Contractor shall have placed orders for specified materials promptly after contract is awarded and the specified products cannot be delivered to the project to meet the Owner's construction schedule.
2. The reason for the unavailability is beyond the Contractor's control, i.e., due to strikes, bankruptcy, discontinuance of manufacturer, acts of God.
3. The specified product is no longer manufactured.
4. There is compelling economic advantage to the Owner.
5. There is compelling sustainable or environmental advantage.

D. In all cases, should a substituted material result in requiring system or building modifications; the Contractor alone shall pay all costs to provide these modifications including all costs to the Engineer and Architect for redesign, and updating of record drawings required to accommodate the required modifications.

PART 3 EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft. Handle all equipment carefully to prevent damage, breakage, denting, and scoring of finishes. Do not install damaged equipment.

B. Store products subject to damage by the elements above ground, undercover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instruction.

3.02 CUTTING BUILDING CONSTRUCTION

A. Obtain permission from the Architect and coordinate with other trades prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills or concrete saws except where space limitations prevent the use of such tools.

B. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.03 FIRESTOPPING

A. Apply firestopping to communications penetrations of fire rated floor and wall assemblies to maintain fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.04 PAINTING

A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.05 EQUIPMENT CONNECTION

A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide complete all connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project.

B. Investigate existing equipment to be relocated and provide new connections as required.

C. Obtain rough-in requirements for equipment furnished under other divisions of this specification prior to roughing-in. Review shop drawings and submittals of other Divisions to determine requirements.

3.06 CLEAN UP

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by this work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workers, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

1. Wipe surfaces of low voltage equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
2. Equipment installed prior to final clean-up shall be cleaned by the contractor. Jacks and patch panels that have construction dirt and dust shall be cleaned to like new condition.

B. Materials recycling and salvage:

1. Recycle all scrap metal.
2. Salvage operable equipment removed from site and deliver to local resale organization.

3.07 TESTING AND DEMONSTRATION

A. Demonstrate that all equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

END OF SECTION 270500

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 270500 – Common Work Results for Communications apply to this Section.

B. Architectural, Electrical, and Telecommunications Drawings. Other systems drawings may apply.

C. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

D. Section 270500 - Common Work Results for Communications Systems.

1.02 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding rods.
5. Grounding labeling.

1.03 REFERENCED STANDARDS AND CODES

A. NFPA 70 National Electric Code.

B. Authority having jurisdiction.

C. Local and State Building Codes.

1.04 DEFINITIONS/ACRONYMS/ABBREVIATIONS

AC	Alternating Current
ACEG	Alternating Current Equipment Ground
AHJ	Authority Having Jurisdiction
AWG	American Wire Gauge
BBC	Backbone Bonding Conductor
BN	Bonding Network
BICSI	Building Industry Consulting Services International
CBC	Coupled Bonding Conductor
CBN	Common Bonding Network

DC	Direct Current
EF	Entrance Facility
EMT	Electrical Metallic Tubing
EOR	Engineer of Record
ESD	Electrostatic Discharge
IBN	Isolated Bonding Network
MTW	Machine Tool Wire
NRTL	National Recognized Testing Laboratory
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
PBB	Primary Bubsbar
PBG	Principal Building Ground
RBB	Rack Busbar
SBB	Secondary Bonding Busbar
SBTC	Solid Bare Tinned Copper
ScTP	Screened Twisted Pair
STP	Shielded Twisted Pair
TBB	Telecommunications Bonding Backbone
TBC	Telecommunications Bonding Conductor
TEBC	Telecommunications Equipment Bonding Conductor
TEF	Telecommunications Entrance Facility
TER	Telecommunications Entrance Room
TIA	Telecommunications Industry Association
UTP	Unshielded Twisted Pair
Backbone:	A facility between telecommunications rooms, the facilities, and the equipment rooms within or between buildings.
Backbone Bonding Conductor (BBC):	The conductor that interconnects elements of the telecommunications grounding infrastructure.
Bonding:	The permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.
Commercial Building:	A building or portion thereof that is intended for office use.
Common Bonding Network (CBN):	The set of metallic components that are interconnected to form the principle means for effectively bonding equipment inside the building to the grounding electrode system.
Conduit:	A raceway of circular cross-section.
Conduit Run:	Multiple sections of conduit that are joined together with fittings.
Conduit System:	Any combination of ducts, conduits, junction boxes, maintenance holes, handholes, and vaults joined to form an integrated whole.
Connecting Hardware:	A device providing mechanical cable terminations.
Earth:	See Ground.

Effectively Grounded:	Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazard to connected equipment or to persons.
Entrance Facility (EF):	An entrance to a building for both public and private network service cables including the entrance point at the building wall and continuing to and including the entrance room or space.
Entrance Point:	The point of emergence of telecommunications conductors through an exterior wall, a concrete floor slab, or from a rigid metal conduit or an intermediate metal conduit.
Entrance Room or Space:	A space in which the joining of inter- or intra-building telecommunications backbone facilities takes place. An entrance room may also serve as an equipment room.
Equipment Room (ER):	An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate cross-connect.
Equipotential Bonding:	Bonding between metallic components to achieve a substantially equal potential.
Exothermic Weld:	A method of permanently bonding two metals together by a controlled heat reaction resulting in a molecular bond.
Ground:	A conducting connection, whether intentional or incidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of earth.
Grounding Conductor:	A conductor used to connect the grounding electrode to the building's main grounding busbar.
Grounding Electrode:	A conductor, usually a rod, pipe or plate (or group of conductors) in direct contact with the earth for the purpose of providing a low impedance connection to the earth.
Grounding Electrode Conductor:	The conductor used to connect the grounding electrode to the equipment grounding conductor, or to the grounded conductor of the circuit at the service equipment, or at the source of a separately derived system.
Grounding Electrode System:	One or more grounding electrodes that are connected together.
Infrastructure (telecommunications):	A collection of those telecommunications components, excluding equipment, that together provide the basic support for the distribution of information within a building or campus.
Listed:	Equipment or materials included in a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or materials meet appropriate designated standards or has been tested and found suitable for use in a specified manner.
Mesh Bonding Network:	A bonding network to which all associated equipment (e.g.: cabinets, frames, racks, trays, pathways) are connected using a bonding grid,

	which is connected to multiple points on the common bonding network.
Pathway:	A facility for the placement of telecommunications cable.
Primary Bonding Busbar (PBB):	A busbar placed in a convenient and accessible location and bonded by means of the bonding conductor for telecommunications to the building service equipment (power) ground.
Protector:	A device consisting of one or more protector units intended to limit abnormal voltages or currents on metallic communications circuits. Includes a mounting assembly for the protector unit.
Protector Unit:	A device intended to protect against either over voltage or over current, or both. The unit may contain carbon arresters, gas tubes, solid state devices, heat coils, PTC devices, or a combination of these components for a specific application.
Secondary Bonding Busbar (SBB):	The interface to the building telecommunications grounding system generally located in the telecommunications room (TR). A common point of connection for telecommunications system and equipment bonding to ground, and located in the TR or equipment room.
Sleeve:	An opening, usally circular, through the wall, ceiling, or floor to allow the passage of cables.
Telecommunications:	Any transmission, emission and reception of signs, signals, writings, images and sounds that is information of any nature by cable, radio, optical or other electromagnetic systems.
Telecommunications Bonding Backbone (TBB):	A conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar(s) (SBB).
Telecommunications Equipment Bonding Conductor (TEBC):	A conductor that connects the Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB) to equipment racks or cabinets.
Telecommunications Bonding Conductor (TBC):	A conductor that interconnects the telecommunications bonding infrastructure to the buildings service equipment (power) ground.
Telecommunications Room (TR):	An enclosed space for housing telecommunications equipment, cable terminations, and cross-connect cabling, that is the recognized location of the horizontal cross-connect.

PART 2 PRODUCTS

2.01 SYSTEM COMPONENTS

A. Comply with ANSI/TIA-607-D.

B. All bonding and grounding connectors shall be listed by NRTL as required by NEC.

C. PRIMARY BONDING BUSBAR (PBB)

1. The Primary Bonding Busbar (PBB) is the dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The PBB is also the central attachment point for the telecommunications bonding backbone(s) and equipment.

D. TELECOMMUNICATIONS BONDING CONDUCTOR (TBC)

1. The telecommunications bonding conductor shall bond the PBB to the electrical service equipment ground. The bonding conductor shall be Machine Tool Wire (MTW) and be sized, as a minimum, the same size as the TBB.

E. TELECOMMUNICATIONS BONDING BACKBONE (TBB) AND BACKBONE BONDING CONDUCTOR (BBC)

1. The TBB originates at the PBB and interconnects all SBBs with the PBB.
2. The TBB extends throughout the building using the telecommunications backbone pathways and connects to the SBBs in all telecommunications rooms and equipment rooms.
3. The BBC connects multiple TBBs, as required.

F. SECONDARY BONDING BUSBAR (SBB)

1. The SBB is the grounding connection point for telecommunications systems and equipment in the area served by that telecommunications room or equipment room.
2. Each SBB shall be bonded to the BBC where required by these specifications.

G. TELECOMMUNICATIONS EQUIPMENT BONDING CONDUCTOR (TEBC)

1. The Telecommunications Equipment Bonding Conductor(s) shall be used to bond all metallic components including conduits, raceways, racks, cabinets, etc. within each Equipment Room (ER) to the SBB or PBB located in that space.

H. TELECOMMUNICATIONS ENTRANCE FACILITY

1. The telecommunications entrance facility (TEF) is the entrance point (room or space within the building) where:
   a. The telecommunications facilities enter.
   b. The joining of inter and intra-building backbone facilities takes place.
   c. The grounding of these facilities is accomplished.
2. The TEF also may include antenna cable entrances and carrier’s electronic equipment serving the telecommunications functions of their systems.
3. The TEF is the desirable location for the PBB. The PBB also may serve as the SBB for the equipment located in the TEF.

2.02 CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Harger Lightning and Grounding.

2. Panduit Corp.
3. Tyco Electronics Corp.
4. Or approved equal.

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.k
2. Cable Tray Equipment Grounding Wire: No. 6 AWG.

D. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG 26 kcmils (13.3 sq. mm) and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

E. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

F. Conductor Sizing Table:

TBB linear length ft (m)	TBB size (AWG)
Less than 13 (4)	6
14 – 20 (4 – 6)	4
21 - 26 (6 – 8)	3
27 - 33 (8 – 10)	2
34 - 41 (10 – 13)	1
42 - 52 (13 – 16)	1/0
53 – 66 (16 – 20)	2/0
67 – 84 (20 – 26)	3/0
85 – 105 (26 – 32)	4/0
106 – 125 (32 – 38)	250 kcmil
126 – 150 (38 – 46)	300 kcmil
151 – 175 (46 – 53)	350 kcmil
176 – 250 (53 – 76)	500 kcmil

251 – 300 (76 – 91)	600 kcmil
Greater than 300 (91)	750 kcmil

2.03 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Chatsworth Products, Inc.
3. Harger Lightning and Grounding.
4. Panduit Corp.
5. Tyco Electronics Corp.
6. Or approved equal.

D. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

E. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

F. Busbar Connectors: Cast silicon bronze, solderless compression-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

G. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.04 GROUNDING BUSBARS [PICK A OR B]

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following :

1. Chatsworth Products, Inc.
2. Harger Lightning and Grounding.
3. Panduit Corp.

4. Or approved equal.

C. PBB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches by 20 inches (6.3 by 100 mm by 508 mm) in cross section. The busbar shall be NRTL listed for use as PBB and shall comply with ANSI/TIA-607-D.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a 4-inch (100-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

D. SBB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches by 10 inches (6.3 by 50 mm by 254 mm) in cross section. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with ANSI/TIA-607-D.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

E. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with ANSI/TIA-607-D. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with) stainless-steel or copper-plated hardware for attachment to the rack.

2.05 GROUND RODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Harger Lightning and Grounding.
2. Tyco Electronics Corp.
3. Or approved equal.

B. Ground Rods: Copper-clad steel[, sectional type]; 5/8 by 96 inches (16 by 2400 mm) in diameter.

2.06 LABELING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brother International Corporation.
2. HellermannTyton.
3. Panduit Corp.
4. SYSTIMAX, A Commscope Company
5. Or approved equal.

B. Comply with ANSI/TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with ANSI/TIA-607-D.

3.03 APPLICATION

A. Conductors: Install solid conductor for No. 6 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the SBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

2. The bonding conductors between the PBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Underground Grounding Conductors: Install bare [tinned-]copper conductor, No. 2 AWG minimum.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm.)

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch (900-mm) intervals.
4. Install grounding and bonding conductors in 3/4-inch (21-mm) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
    a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a SBB.

3.04 GROUNDING ELECTRODE SYSTEM

A. The BCT between the PBB and the ac service equipment ground shall be sized according to the distance between the two devices and according to the Conductor Sizing Table shown above in 2.02.F.

3.05 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 72 inches (1830 mm) above finished floor unless otherwise indicated.

3.06 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the PBB with insulated bonding conductor.

E. Interconnections: Interconnect all SBBs with the PBB with the telecommunications backbone conductor. If more than one PBB is installed, interconnect PBBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor shall be sized according to the distance between the two devices and according to the Conductor Sizing Table shown above in 2.02.F.

F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install [top-mounted] [vertically mounted] rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the SBB No. 2 AWG bonding conductors.

G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each SBB and PBB to the vertical steel of the building frame.

H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each SBB to the ground bar of the panelboard.

I. Shielded Cable: Bond the shield of shielded cable to the SBB in communications rooms and spaces. Comply ANSI/TIA-568.1-E when grounding screened, balanced, twisted-pair cables.

J. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

K. Access Floors: Bond all metal parts of access floors to the SBB.

L. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using No. 6 AWG bonding conductors.

1. Install the conductors in grid pattern on 4-foot (1200-mm) centers, allowing bonding of one pedestal from each access floor tile.
2. Bond the SBB of the equipment room to the reference grid at two or more locations.

3. Bond all conduits and piping entering the equipment room to the SBB at the perimeter of the room.

M. Towers and Antennas:

1. Ground Ring: Buried at least 30 inches (760 mm) below grade and at least 24 inches (610 mm) from the base of the tower or mounting.
2. Bond each tower base and metallic frame of a dish to the ground ring, buried at least 18 inches (460 mm) below grade.
3. Bond the ground ring and antenna grounds to the equipment room PBB or SBB, buried at least 30 inches (760 mm) below grade.
4. Bond metallic fences within 6 feet (1.8 m) of towers and antennas to the ground ring, buried at least 18 inches (460 mm) below grade.
5. Special Requirements for Roof-Mounted Towers:
   a. Roof Ring: Meet requirements for the ground ring except the conductors shall comply with requirements in Section 264113 "Lightning Protection for Structures."
   b. Bond tower base footings steel, the SBB in the equipment room, and antenna support guys to the roof ring.
   c. Connect roof ring to the perimeter conductors of the lightning protection system.
6. Waveguides and Coaxial Cable:
   a. Bond cable shields at the point of entry into the building to the SBB and to the cable entrance plate, using No. 2 AWG bonding conductors.
   b. Bond coaxial cable surge arrester to the ground or roof ring using bonding conductor size recommended by surge-arrester manufacturer.

3.07 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label PBB(s) with "fs-PBB," where "fs" is the telecommunications space identifier for the space containing the PBB.
2. Label SBB(s) with "fs-SBB," where "fs" is the telecommunications space identifier for the space containing the SBB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.08 FIELD QUALITY CONTROL

A. Independent Testing Agency: Engage an independent electrical testing organization to perform tests described below.

B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81-1983 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements.

C. Two-point ground continuity testing:

1. This procedure will help determine if there is an acceptable maximum level of resistance between any point in the telecommunications bonding and grounding system and the building's electrical grounding electrode system. The test is performed using an earth ground resistance tester that is configured for a continuity test, otherwise known as a two-point test or a "dead earth" test.
2. Prior to two-point ground testing, a visual inspection shall be performed to verify that the bonding and grounding system is installed according to the guidelines in ANSI/TIA-607.
3. A voltage test should be performed prior to conducting the two-point continuity test due to the possibilities of ground faults traveling through the telecommunications bonding and grounding system. Consult with other contractors to ensure other electrical work does not interfere with this test.
4. This test shall be performed in the following areas:
    a. PBB/SBB to the electrical ground at the TEF.
    b. PBB/SBB to the building steel (if present).
    c. PBB to SBB.
    d. Building steel (if present) to the electrical ground.
5. The recommended maximum value for resistance between any point in the telecommunications bonding and grounding system and the building's electrical grounding electrode system is 100 milliohms. In the case of long TBB and BBC conductor runs, the resistance of the conductor must be factored into the total resistance.

D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.09 EXISTING WORK

A. Demolition Drawings are based on field observations **and existing record documents**. Report discrepancies to Owner and Architect/Engineer before disturbing existing installation.

B. Disconnect telecommunications systems in walls, floors, and ceilings scheduled for removal.

C. Remove, relocate and extend existing installations to accommodate new construction.

D. Repair adjacent construction and finishes damaged during demolition and extension work.

E. Remove exposed abandoned grounding and bonding components.

END OF SECTION 270526

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 270500 – Common Work Results for Communications apply to this Section.

B. Section 270500 - Common Work Results for Communications Systems.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 270533 "Conduits and Backboxes for Communications Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.03 REFERENCED STANDARDS AND CODES

A. NFPA 70 National Electrica Code.

B. Authority having jurisdiction.

C. Local and State Building Codes.

1.04 DEFINITIONS

ARC	Aluminum rigid conduit.
GRC	Galvanized rigid steel conduit.
IMC	Intermediate metal conduit.

EMT	Electrical metallic tubing
PVC	Polyvinyl Chloride
RNC	Rigid non-metallic conduit
HDPE	High-density polyethylene
RTRC	Reinforced thermosetting resin conduit

1.05 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.06 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For pathway racks, enclosures, cabinets, equipment racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 PRODUCTS

2.01 CONDUIT SYSTEM

A. Contractor shall provide a complete empty metal raceway system consisting of all conduit, cable tray, ladder tray, fittings, bushings, pullboxes (plenum approved as required), outlet boxes, etc. for a fully functional system. Conduit routing denoted on drawings is diagrammatic and contractor shall coordinate entire conduit installation with the architect, engineer of record (EOR), other trades and with field conditions prior to installation. Exact conduit lengths shall be coordinated by the contractor so as to not exceed cable length limitations as directed by telecommunications specifications. The Telecommunications raceway system shall be installed directly above finished ceiling and/or beneath all other utility distribution systems. Proper clearance shall be maintained for future placement of cable.

B. All conduit raceway sizes are based on unshielded 24 gauge 4-pair twisted pair cabling with a nominal outside diameter of .24 or smaller inches. The exact quantity of cables per outlet location shall be confirmed with the telecommunications cable specifications, and drawings so as to not exceed 40% fill for greater than two cables within a raceway. The exact quantity and type of cable(s) per wall or floor telecommunications outlets shall be determined by the telecommunications specifications and construction drawings. Use only symbols shown on telecommunications drawings for quantities to be bid and installed as part of this project.

C. Minimum conduit sizing for all telecommunications outlets shall be 1 inch unless noted otherwise.

D. All modular jacks and plates for wall, floor and furniture base systems shall be provided by the contractor. All wall boxes for telecommunications outlets shall be installed by the contractor and be sized minimum 4-11/16” X 4-11/16”X 2-1/8”deep junction boxes with a (single or double) gang plaster ring opening unless noted otherwise. Mounting height of plate shall be as specified on architectural drawings.

E. Exact location of conduit terminations for telecommunications homerun conduits shall be coordinated with the telecommunications drawings. Contractor shall stub all conduits into telecommunications room(s) as required by the telecommunications drawings and specification and provide and insulated grounding bushing for each conduit end. Contractor shall provide a #6 AWG grounding conductor from each grounding bushing to the copper ground bar located within the telecommunications room.

F. Refer to Technology Drawing Symbols and Abbreviations sheet for quantity of cables allowed per conduit.

G. Exact conduit layouts shall be determined by the contractor in coordination with the field conditions, other trades and/or EOR including all necessary pullboxes.

H. Contractor shall provide a pullstring for each empty telecommunications conduit run installed as a part of this project.

I. Wall sleeves are to be provided for all wall penetrations. Sleeves shall extend a minimum of (4) inches beyond the finished surface of the wall on each side. Sleeves are to be filled no greater than 40%. All sleeves are to be equipped with an insulated grounding bushing and grounded with a #6 conductor. Sleeves are to be installed and sealed to meet or exceed intended fire rating of walls penetrated.

J. Floor sleeves are to be provided for all floor penetrations. Floor sleeves shall extend a minimum of (18) inches above the finished floor and (6) inches below the finished ceiling. Sleeves are to be filled no greater than 40%. All sleeves are to be equipped with an insulated grounding bushing and grounded with a #6 conductor. Sleeves are to be installed and sealed to meet or exceed intended fire rating of the floor being penetrated.

2.02 METAL CONDUITS AND FITTINGS

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. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Electri-Flex Company.
4. O-Z/Gedney; a brand of EGS Electrical Group.
5. Southwire Company.
6. Thomas & Betts Corporation.
7. Or approved equal.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with ANSI/TIA-569-E.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated [rigid steel conduit] [IMC].

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel.
   b. Type: Setscrew.
      1) The contractor shall coordinate the type and material with the Electrical team.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair companynVent | Hoffman.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.
5. Or approved equal.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with ANSI/TIA-569-E.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.04 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with ANSI/TIA-569-E.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
   a. Mono-Systems, Inc.

b. Panduit Corp.
c. Wiremold / Legrand.
d. Or approved equal.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated; Wiring Device-Kellems Division.
   b. Lamson & Sessions; Carlon Electrical Products.
   c. Mono-Systems, Inc.
   d. Panduit Corp.
   e. Wiremold / Legrand.
   f. Or approved equal.

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Chatsworth Products

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with ANSI/TIA-569-E.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable,round.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

J. Device Box Dimensions: 4-11/16 inches square by 2-1/8 inches deep (119 mm square by 60 mm deep).

K. Gangable boxes are allowed.

L. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures:
   a. Material: Plastic.
   b. Finished inside with radio-frequency-resistant paint.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 EXECUTION

3.01 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: [EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

c. Mechanical rooms.
d. Gymnasiums

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: GRC.
6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway.
8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: General-use, optical-fiber-cable pathway.
9. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

B. Minimum Pathway Size: 1-inch (27 mm) trade size. Minimum size for optical-fiber cables is 1-inch (27 mm).

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use a sealant recommended by the fitting manufacturer and apply in a thickness and number of coats recommended by manufacturer.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Install surface pathways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds **[120 deg F (49 deg C)]**.

3.02 INSTALLATION

A. Comply with NECA 1, NECA 101, and ANSI/TIA-569-E for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
3. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to RNC, Type EPC-40-PVC, before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

R. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC **[and EMT]** conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: [125 deg F (70 deg C)] temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: **[155 deg F (86 deg C)]** temperature change.
c. Indoor Spaces Connected with Outdoors without Physical Separation: **[125 deg F (70 deg C)]** temperature change**.**
d. Attics: **[135 deg F (75 deg C)]** temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

CC. Set metal floor boxes level and flush with finished floor surface.

DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.04 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 270533 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 270500 - Common Work Results for Communications apply to this Section.

B. Other References

1. Commercial Building Standard for Telecommunications Pathways and Spaces
2. Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
3. Section 270500.

1.02 DESCRIPTION

A. Provide raceway systems for the installation of the communications cabling. Installation shall include:

1. Raceways and Wireways (including sleeves, expansion fittings, penetrations and seals)
2. Pull and Junction Boxes
3. Outlet Boxes, mud rings, and cover plates
4. Indoor Service Poles
5. Poke-through Fittings
6. Floor Boxes

1.03 SUBMITTALS

A. General: Provide submittal information in accordance with Section 270500 - Common Work Results for Communications and supplementary requirements described in this specification.

B. Product Data: Provide the following:

1. Product data on all cable support devices and accessories. Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.

C. Shop Drawings: For projects where the low voltage systems cable pathways are not shown on the drawings, they are to be contractor designed per Part 3. The contractor shall prepare and submit proposed main pathway (defined as 20 cables or more), layout drawings for review and approval by the Owner's representative prior to installing supports. Shop drawings shall:

1. Indicate pathways on plan view showing pathway coordination with mechanical components, lighting components, sprinkler head components, plumbing components and electrical components.

2. Include elevations and sections to indicate space allocations and coordination with work of other trades.
3. Include details to describe the different support configurations, accessories, attaching means and cable groupings.

D. Closeout Submittals – In accordance with section 270500.

PART 2 PRODUCTS

2.01 WALL OUTLETS

A. Surface wall outlets shall be 4" square, 2-3/4" deep (minimum) and shall match and be manufactured by the surface metal raceway manufacturer.

2.02 FLOOR OUTLETS

A. See Section 260533.10 - Flush Floor Outlets for flush floor outlets.

B. See Section 260533.20 - Floor Outlet Devices Poke Thru for poke-thru floor outlets.

2.03 DEVICE PLATES

A. Provide blank device cover plates for all un-cabled or "future" outlets.

2.04 PULL WIRE

A. Shall be plastic having not less than 200-pound tensile strength.

PART 3 EXECUTION

3.01 WALL OUTLETS IN WALLS WITH ACCESSIBLE CEILINGS

A. Provide a minimum 1” individual conduit from each outlet location to an accessible ceiling space. Provide non-metallic conduit bushing prior to cable installation.

3.02 WALL OUTLETS IN WALLS WITH NON-ACCESSIBLE CEILINGS

A. Provide an individual conduit from each outlet location to an accessible ceiling space. Provide non-metallic conduit bushing prior to cable installation.

3.03 FLOOR MOUNTED OUTLETS

A. All conduits from floor outlets shall terminate in a space on the same floor as the outlet.

B. Provide an individual conduit from each outlet location to an accessible ceiling space.

3.04 FLOOR OUTLETS/ BOXES IN SLAB ON GRADE

A. Provide an individual conduit from each outlet box to a consolidation point interior to the building within 25 feet of the point where the conduit exits the slab.

3.05 SYSTEM FURNITURE CONNECTIONS

A. Provide a minimum 1-1/4" individual conduit from each wall connection location to an accessible ceiling space.

B. Provide a minimum 1-1/4" individual conduit from each wall connection outlet to an accessible location at cable tray or to the serving communications room.

3.06 SURFACE METAL RACEWAY CONNECTIONS

A. Provide an individual conduit from each surface raceway to an accessible ceiling space.

3.07 RACEWAYS

A. Shall conform to specification as outlined in section 1.01, and Division 27 related sections - with the additional requirement that no length of run shall exceed 100 feet and shall not contain more than two 90-degree bends or the equivalent without a code size pull box sized per Pull Box Sizing table below. Provide pull boxes where necessary to comply with these requirements. Locate pull boxes in straight runs only, not as a replacement for an elbow.

B. Conduits with an internal diameter of two inches or less shall have a bend radius at least 6 times the internal conduit diameter. Conduits greater than two inches shall have a bend radius at least 10 times the internal conduit diameter.

C. Provide an insulated bushing on all conduits terminated in an enclosure, prior to cable installation.

D. Terminate conduits stubbed out above accessible ceiling space so that the conduit is parallel with the ceiling and provide an insulating bushing, prior to cable installation.

E. Terminate conduit at cable trays at an accessible location within 6" of tray with an insulated bushing and provide bonding jumper or terminate conduit to the cable tray with an insulated bushing. Provide insulated bushing on conduits prior to cable installation.

3.08 PULL CORDS

A. Nylon type pull cords shall be included in all raceways over 10 feet long. Leave not less than 12 inches of slack at each end of the pull wire.

3.09 RACEWAY RISER SLEEVES

A. Riser raceways to be installed through floors with tops 6 inches above each floor to give continuous cable riser capability. Provide Firestopping to meet requirements of Division 01.

END OF SECTION 270533

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

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. Section 270500 - Common Work Results for Communications

1.02 DESCRIPTION

A. Provide complete cable tray system including straight tray sections, fittings, splice plates, and cable tray supports to support cable systems in locations as indicated on drawings.

B. Cable tray system is intended to carry communications cable only. Fire alarm system and overhead page cables are not allowed.

C. Section Includes:

1. Ladder cable trays.
2. Wire-basket cable trays.

1.03 REFERENCES

A. As indicated in Section 270500.

1.04 SUBMITTALS

A. General: Provide submittal information in accordance with Section 270500 - Common Work Results for Communications and supplementary requirements described in this specification.

B. Product Data: For each type of cable tray.

1. Include data indicating dimensions and finishes for each type of cable tray indicated.

C. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

D. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

E. Closeout Submittals – In accordance with section 270500.

1.05 QUALITY ASSURANCE

A. Cable tray and accessories shall comply with NEMA VE 1.

1.06 COORDINATION

A. Coordinate as required in section 270500.

B. Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
2. Vertical and horizontal offsets and transitions.
3. Clearances for access above and to side of cable trays.
4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.

C. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Drawings for specific requirements

C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.02 LADDER CABLE TRAYS

A. Manufacturers:

1. nVent Hoffman
2. Chatsworth Products, Inc.

B. Description:

1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
2. Rung Spacing: 6 inches (150 mm) o.c.
3. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
5. No portion of the rungs shall protrude below the bottom plane of side rails.
6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
7. Minimum Usable Load Depth: 3 inches (75 mm).
8. Straight Section Lengths: 10 feet (3 m) except where shorter lengths are required to facilitate tray assembly.
9. Width: 6 inches (150 mm) unless otherwise indicated on Drawings.
10. Fitting Minimum Radius: 12 inches (300 mm).
11. Class Designation: Comply with NEMA VE 1, Class 5AA.
12. Splicing Assemblies: Bolted type using serrated flange locknuts.
13. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.
14. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.03 WIRE-BASKET CABLE TRAYS

A. Manufacturers:

1. nVent WBT
2. Chatsworth Products, Inc.

B. Description:

1. Configuration: Wires are formed into a standard 2-by-4-inch (50-by-100-mm) wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
2. Materials: High-strength-steel longitudinal wires with no bends.
3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
4. Sizes:
   a. Straight sections shall be furnished in standard lengths.
   b. Wire-Basket Depth: 1-inch (25-mm) usable loading depth by 4 inches (100 mm) wide.
   c. Wire-Basket Depth: 2-inch (50-mm) usable loading depth by 4 inches (100 mm) wide.
   d. Wire-Basket Depth: 4-inch (100-mm) usable loading depth by 8 inches (200 mm) wide.
   e. Wire-Basket Depth: 6-inch (150-mm) usable loading depth by 8 inches (200 mm) wide.
5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
7. Hardware and Fasteners: Shall be of the same manufacture as cable tray.

2.04 MATERIALS AND FINISHES [RETAIN ONE OF SIX 'FINISHES' PARAGRAPHS BELOW]

A. Steel:

1. Finish: Electrogalvanized before fabrication.
   a. Standard: Comply with ASTM B 633.
   b. Hardware: Galvanized, ASTM B 633.

2.05 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.06 WARNING SIGNS

A. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel." Place at each end of tray and at 20’-0” intervals along span of tray.

2.07 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA FG 1.

PART 3 EXECUTION

3.01 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA FG 1.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.

F. Fasten cable tray supports to building structure and install seismic restraints.

G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg).

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Support tray assembly to prevent twisting from eccentric loading.

K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.

L. Locate and install supports according to NEMA FG 1. Do not install more than one cable tray splice between supports.

M. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.5.

N. Support wire-basket cable trays with center support hangers.

O. Support center support hangers for wire-basket trays with 3/8-inch- (10-mm-) diameter rods.

P. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

Q. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA FG 1. Space connectors and set gaps according to applicable standard.

R. Make changes in direction and elevation using manufacturer's recommended fittings.

S. Make cable tray connections using manufacturer's recommended fittings.

T. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078000 "Penetration Firestopping."

U. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

V. Install cable trays with enough workspace to permit access for installing cables.

W. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.

X. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

Y. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.02 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" and Section 270526 "Grounding and Bonding for Communications Systems."

B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.03 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or Velcro cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket.

C. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).

D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

E. In existing construction, remove inactive or dead cables from cable trays.

3.04 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.06 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 270536

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

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. Architectural, Electrical, and Telecommunications Drawings. Other systems drawings may apply.

C. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

D. Vertical Transportation (Elevators, Escalators, etc.) Specifications and/or Codes Requirements.

E. Rough carpentry is specified in a Division 6 section.

1.02 SUMMARY

A. Section Includes:

1. Signs.
2. Bands and tubes.
3. Cable ties.
4. Miscellaneous identification products.
5. Labels.

1.03 REFERENCED STANDARDS AND CODES

A. Cornell Design & Construction Standards, Div. 27 for Labeling requirements.

B. NFPA 70 National Electric Code.

C. Authority having jurisdiction

D. Local and State Building Codes.

E. UL® for wiring: UL® Standard 910 “Test method for fire and smoke characteristics of cable used in air handling spaces.” Provide products that are UL® listed and labeled for such use. UL® testing bulletin. Underwriters Laboratories (UL®) cable certification and follow up program.

F. American National Standards Institute/Telecommunications Industry Association.

G. Section 270500 Common Work Results for Communications Systems

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation.
2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation.
3. Racks: Scaled drawings indicating location and proposed designation.
4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations.

PART 2 PRODUCTS

2.01 TELECOMMUNICATIONS SPACES

A. All telecommunications spaces shall be identified inside the room, with the identifier located so as to be visible to someone working in that room.

2.02 HORIZONTAL LINK

A. FACEPLATE LABELS

1. Faceplates shall be identified with machine printed permanent ink or laser printed labels. Text size shall be ¼" high. Dot-matrix printing shall not be acceptable. Labels shall be placed under the transparent faceplate label protector. Under no circumstances shall adhesive backed labels be placed on the surface of the faceplate. Refer to engineering communications drawings for information about the numbering scheme.
2. Acceptable Manufacturers – Labeling manufacturers shall match that of the selected cabling system. If unavailable, labeling components from these manufacturers will be accepted.
    a. Commscope
3. Panduit
    a. Wiremold
    b. Or Approved Equal

B. FLOOR TERMINATION BOX LABELS

1. Floor Termination Box shall be identified with machine printed permanent ink or laser printed labels. Text size shall be ¼" high. Dot-matrix printing shall not be acceptable. Labels shall be placed under the transparent faceplate label protector. Under no circumstances shall adhesive backed labels be placed on the surface of the faceplate. Refer to engineering communications drawings for information about the numbering scheme.
2. Acceptable Manufacturers – Labeling manufacturers shall match that of the selected cabling system. If unavailable, labeling components from these manufacturers will be accepted.
   a. Commscope
   b. Panduit
   c. Or Approved Equal

C. CABLE LABELS

1. All horizontal cables shall be identified at each end, 12 to 18 inches from termination, with machine printed, permanent or laser printed self-lamenting labels. Dot-matrix printing shall not be acceptable. Refer to engineering communications drawings for information about the numbering scheme.
2. Acceptable Manufacturers – Labeling manufacturers shall match that of the selected cabling system. If unavailable, labeling components from these manufacturers will be accepted.
   a. Commscope
   b. Panduit
   c. Or Approved Equal

D. WIRING BLOCK LABELS

1. 110 style blocks shall be identified with machine printed permanent ink or laser printed labels. A transparent plastic label holder that snaps into the 110-style wiring bock shall protect the labels and shall be included with the blocks.
2. Wiring block labels shall be color coded to denote blocks by the types of connections:
   a. Demarcation point orange
   b. Network connection green
   c. Common equipment purple
   d. Key system red
   e. First level backbone white
   f. Second level backbone gray
   g. Campus backbone brown
   h. Horizontal blue
   i. Miscellaneous yellow
3. Acceptable Manufacturers – Labeling manufacturers shall match that of the selected cabling system. If unavailable, labeling components from these manufacturers will be accepted.
   a. Commscope
   b. Panduit

c. Or Approved Equal

E. PATCH PANEL LABELS

1. Copper and fiber patch panels shall be identified with machine printed permanent ink or laser printed labels.
2. Acceptable Manufacturers – Labeling manufacturers shall match that of the selected cabling system. If unavailable, labeling components from these manufacturers will be accepted.
   a. Commscope
   b. Panduit
   c. Or Approved Equal

2.03 EQUIPMENT RACK/CABINET LABELS

A. All cabinets and racks shall be labeled with engraved plastic name plates, 2” in height with minimum 1” high lettering.

B. Rack and cabinet labels shall be located at front and rear, at top or other designated visible location.

2.04 PRIMARY BONDING BUSBAR (PBB)

A. All ground bars shall be labeled with machine printed permanent ink or laser printed adhesive backed, identification labels.

2.05 SECONDARY BONDING BUSBAR (SBB)

A. All ground bars shall be labeled with machine printed permanent ink or laser printed adhesive backed, identification labels.

2.06 FIRESTOP LOCATION

A. All firestop locations shall be identified on each side of the penetrated fire barrier, within 12 inches of the firestopping material.

2.07 PATHWAYS

A. All pathways shall be identified at each end, 12 to 18 inches from termination, with machine printed, permanent or laser printed self-lamenting labels. Dot-matrix printing shall not be acceptable.

B. Pathways to include:

1. Intra-Space Pathway
2. Building Pathway
3. Outside Plant Pathway

4. Campus Pathway

2.08

PART 3 EXECUTION

4.01 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

4.02 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6 inches (150 mm) from cable end.

I. Snap-Around Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches (150 mm) from cable end.

J. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6 inches (150 mm) from cable end.

K. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

L. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

M. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [or concrete envelope] exceeds 16 inches (400 mm) overall.

1. Limit use of underground-line warning tape to direct-buried cables.

B. Cable Ties: General purpose, except as listed below:

1. In Spaces Handling Environmental Air: Plenum rated.

5.02 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

1. System legends shall be as follows: TELECOMMUNICATIONS.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation _____, composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.

3. Faceplate number.

E. Equipment Room Labeling:

1. Data Outlets: Label each outlet with a self-adhesive label indicating the following, in the order listed:
   a. Room number
   b. Colon
   c. Faceplate Number

F. Horizontal Cables: Label each cable with a vinyl-wraparound label indicating the following, in the order listed:

1. Room number
2. Colon
3. Faceplate number

G. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

H. Instructional Signs: Self-adhesive labels.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

J. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign.
3. Equipment to Be Labeled:
   a. Communications Cabinets
   b. Uninterruptible Power Supplies
   c. Computer Room Air Conditioners
   d. Fire Alarm and Suppression Equipment
   e. Egress Points
   f. Power Distribution Components

END OF SECTION 270553

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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. Section 270500 - Common Work Results for Communications

C. Architectural, Electrical, and Telecommunications Drawings. Other systems drawings may apply.

D. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

E. Vertical Transportation (Elevators, Escalators, etc.) Specifications and/or Codes Requirements.

F. Rough carpentry is specified in a Division 6 section.

1.02 SUMMARY

A. Section Includes:

1. Communications equipment and hardware mounting elements.
2. Backboards.
3. Communications equipment racks and cabinets.
4. Grounding.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

1.04 SUBMITTALS

A. General: Provide submittal information in accordance with Section 270500 - Common Work Results for Communications and supplementary requirements described in this specification.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

D. Closeout Submittals – In accordance with section 270500.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

PART 2 PRODUCTS

2.01 BACKBOARDS

A. Backboards: Plywood, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). APA interior grade Douglas Fir A-C. Shall be fire retardant treated with flame spread rating not more than 25 when tested according to ASTM E84. Paint with light colored (white or off white) fire retardant paint. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

1. Backboards are to start +12" AFF and extend to a height of +9' AFF.
2. Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.
3. Painted with two (2) coat of paint. Painted finish in the room will be light colored to enhance room lighting.
4. One (1) fire-retardant stamp is to be left unpainted on the bottom of each individual piece of fire-retardant plywood.

2.02 EQUIPMENT FRAMES

A. Manufacturers: provide products by the following, subject to compliance with requirements. No substitutions will be permitted.

1. Panduit Por Chatsworth Products Inc.
   a. For equipment racks
2. Panduit Corp.
   a. For cable management

B. Vertical Cable Management for Equipment Frames:

1. Vertical wire management shall be Panduit PR2VD06 at rack ends and Panduit PR2VD10 between racks.

C. Horizontal Cable Management for Equipment Frames:

1. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
2. Horizontal wire management shall be Panduit WMPH2E between patch panels and Panduit CMPHH2 at the top and bottom of the rack.

2.03 20-INCH EQUIPMENT RACKS

A. Description: Two-post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch (482.6-mm) equipment mounting with an opening of 17.72-inches (450-mm) between rails.

B. Approved manufacturer for racks shall be Chatsworth Products, Inc. (CPI). Substitutions are not permitted.

C. General Requirements:

D. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

1. Material: Extruded steel.
2. Finish: Manufacturer's standard, baked-polyester powder coat.
3. Color: [Black].

E. Floor-Mounted Racks:

1. Overall Height: 84 inches (2133.6 mm).
2. Overall Depth: 13 inches (330.2 mm) .
3. Upright Depth: 3 inches (76.2 mm)???.
4. Two-Post Load Rating: 200 lb (91 kg).
5. Four-Post Load Rating: 1000 lb (454 kg).
6. Number of Rack Units per Rack: 45.
   a. May describe a feature not available from all manufacturers.Numbering: Every rack units, on interior of rack.
7. Threads: 10-32.
8. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[, and a power strip].
9. Base shall have a minimum of four mounting holes for permanent attachment to floor.
10. Top shall have provisions for attaching to cable tray or ceiling.
11. Self-leveling.

2.04 POWER DISTRIBUTION UNITS (PDUS)

A. Power Distribution Units (PDUs) shall be supplied and installed by the owner.

2.05 TERMINATION HARDWARE

A. Jack Panels

1. Patch panel shall be high density such that 24-ports occupy 1 rack unit and 48-ports occupy 2 rack units.
2. Jack panels are populated with information outlets
3. Patch panel shall have front silk-screened port identification.
4. Patch panel shall have front write-on designation areas.
5. Patch panel shall be Mini-Com compatible
6. Acceptable products for termination hardware. No substitutions will be accepted:
    a. Panduit and Mini-com compatible

B. Patch panels

1. Patch panel shall be high density such that 24-ports occupy 1 rack unit and 48-ports occupy 2 rack units.
2. Shall use Category 6 or 6A as indicated in drawings, UMJ8 RJ45 jacks in 6- or 8-port modules.
3. Patch panel jack (UMJ 8 position/8 conductor) shall terminate to a 110D-type insulation displacement contact, printed circuit board or lead frame mounted connector.
4. Patch panel jack shall be universal modular jack, 8 position, un-keyed unless noted otherwise.
5. Patch panel jack shall utilize T568-A or T568-B wiring scheme. Wiring scheme shall match that used at information outlet.
6. Patch panel jack shall support termination of 22, 24 and 26 AWG solid conductor, four pair, unshielded twisted pair copper cable.
7. Patch panel shall have cable management bar to ensure proper bend radius and strain relief.
8. Shall have front silk-screened performance marking.
9. Patch panel shall have front silk-screened port identification.
10. Patch panel shall have front write-on designation areas.
11. Patch panel shall have the ability to accept color-coded identification tabs and port protecting shutters.
12. Patch panel shall be compliant with ANSI/TIA-606 labeling specifications.
13. Acceptable products:
    a. All patch panels shall be manufactured by the same manufacturer as the information outlets and other termination hardware.
    b. Acceptable manufacturers. No substitutions shall be accepted:
        1) Panduit

PART NUMBER SHALL BE PANDUIT CPPL48WBLY

3.01 LADDER RACKING/CABLE RUNWAY

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Chatsworth Products Inc.
2. nVent / Hoffman

B. Cable Runway Requirements: Rectangular steel tubing, 1-1/2”x3/8”x0.065”. Cross members welded at 12” intervals.

C. Cable Runway Accessories: Provide cable runway with the following accessories:

1. Cable runway radius drop (“waterfalls”)
2. Butt-splice kit
3. Junction splice kit
4. 3” or 6” Channel Rack-to-runway mounting plate
5. Triangular support bracket
6. Wall angle support kit
7. End closing kit
8. End caps
9. Vertical wall bracket kit
10. Threaded drop radius
11. 6”, 8” or 10” Cable retaining posts

3.02 CABLE SPILLWAYS

A. Fits 4” diameter EMT conduits. Blue in color, made of fire-retardant ABS and stainless steel.

1. Manufacturer: Bejed, part number BJ-2049

3.03 PATHWAYS FOR FIRE RATED PENETRATIONS

A. Floor or wall fire rated pathway for communications cables.

1. Manufacturer: STI, Inc., part number EZ-Path Series 22.
2. Manufacturer: STI, Inc., part number EZ-Path Series 33.
3. Manufacturer: STI, Inc., part number EZ-Path Series 44+.
4. Manufacturer: Hilti, part number CP 653 2”.
5. Manufacturer: Hilti, part number CP 653 4”.

3.04 GROUNDING

A. Comply with ANSI/TIA-607-D, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

B. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

C. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

3.05 LABELING

A. Comply with ANSI/TIA-606-C and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 EXECUTION

4.01 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

4.02 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

4.03 FIRESTOPPING

A. Comply with requirements in Division 07 "Penetration Firestopping."

B. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

4.04 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI/TIA-607-D.

C. Comply with Section 260526 “Grounding and Bonding for Electrical Systems”.

D. Comply with Section 270526 “Grounding and Bonding for Communications Systems”.

4.05 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C. Comply with requirements in Section 2760553 "Identification for Electrical Communications Systems."

B. Comply with requirements in Division 09 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-B for Class 2 level of administration [including optional identification requirements of this standard].

D. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

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. Section 270500 - Common Work Results for Communications

C. Architectural, Electrical, and Telecommunications Drawings. Other systems drawings may apply.

D. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

E. Vertical Transportation (Elevators, Escalators, etc.) Specifications and/or Codes Requirements.

F. Rough carpentry is specified in a Division 6 section.

1.02 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Multiuser telecommunications outlet assemblies.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Telecommunications outlet/connectors.
5. Cabling system identification products.
6. Cable management system.

B. Related Requirements:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.03 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

H. RCDD: Registered Communications Distribution Designer.

I. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.05 SUBMITTALS

A. General: Provide submittal information in accordance with Section 270500 - Common Work Results For Communications and supplementary requirements described in this specification.

B. Product Data: For each type of product.

1. Provide submittals as required in section 270500.

C. Shop Drawings:

1. Provide shop drawings as required in section 270500.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: [One] of each type.
2. Connecting Blocks: [One] of each type.
3. Device Plates: [One] of each type.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cables to determine the continuity of the strand end to end. Use [optical fiber flashlight] [or] [optical loss test set] .

2. Test optical fiber cables while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

PART 2 PRODUCTS

2.01 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. ANSI/TIA-568.1-E requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in ANSI/TIA-568.1-E when tested according to test procedures of this standard.

B. 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.

C. Grounding: Comply with ANSI/TIA-607-D.

D. The overall diameter of the cable shall be less than 0.230.23” inches.

2.03 AUGMENTED CATEGORY 6 (CAT 6A) CHANNELS

A. Cable

1. All Augmented Category 6 (Cat 6A) UTP cables shall consist of a 4-pair, 22 - 24 gauge UTP and shall terminate on 8-pin modular jacks at each information outlet.

2. All cable jacket material shall conform to article 800 NEC for use as plenum or non-plenum cables. Cables shall be UL® type CMP (plenum), CMR (riser) or type CM (general) as appropriate.
3. All cable shall be tested and guaranteed to meet or exceed the requirements for Augmented Category 6 performance as defined in ANSI/TIA-568, and be part of the UL® LAN certification and follow-up program.
4. Cables shall meet the following physical requirements:
   a. Shall consist of four (4) 22-24 AWG twisted pairs.
   b. Shall be suitable for the environment in which they are to be installed.
   c. The overall diameter of the cable shall be less than 0.354 inches.
   d. Cable shall withstand a bend radius of 4 times the cable diameter at -20□ C without damage to jacket or insulation.
5. Plenum rated cables (as required)
   a. Shall be plenum rated and meet applicable requirements of ANSI/ICEA S-80-576 for plenum. All four pairs must be insulated with F.E.P. No constructions that use mixed insulation materials will be allowed.
6. Acceptable manufacturers and products in alphabetical order are as follows:
   a. CommScope
   b. General Cable / Prysmian
   c. Panduit

B. Information Outlets

1. Augmented Category 6 Information Outlets shall meet the following requirements:
2. All Augmented Category 6 information outlets shall meet or exceed attenuation, NEXT, A-NEXT and all other Augmented Category 6 transmission performance requirements for connecting hardware, as specified in ANSI/TIA-568 Commercial Building Telecommunications Cabling Standard and be part of the UL® LAN Certification and Follow-up program.
   a. All Augmented Category 6 information outlets shall be capable of being utilized in a modular patching situation or as a modular telecommunication outlet (TO).
3. Wiring termination sequence for all Augmented Category 6 information outlets shall be compatible with T-568A and T-568B wiring scheme.
   a. Snap-on icons shall identify the outlets by color and/or usage.
   b. General specifications:
      1) Meets or exceeds the mechanical, electrical and clearance specifications in FCC Rules and Regulations, Part 68, Subpart F.
      2) Certifications: UL listed; CSA certified.
   c. Acceptable products:
      1) All information outlets shall be manufactured by the same manufacturer as the faceplate and other termination hardware.
      2) Acceptable manufacturers and products in alphabetical order are as follows:
         (a) CommScope
         (b) General Cable / Prysmian
         (c) Panduit Minicom

2.04 FACEPLATES

A. The faceplates shall meet the following requirements:

1. UL® listed and CSA certified.
2. Constructed of high-impact, ABS plastic.
3. Faceplates shall be available in a variety of colors to match other utilities or raceways installed.
4. Available as single-gang (1-6 ports) or dual-gang (6-12 ports).
5. Posses recessed designation windows to facilitate labeling and identification.
6. Shall include a clear plastic cover to protect labels in the designation window.
7. Have mounting screws located under recessed designation windows.
8. Comply with ANSI/TIA-606 labeling specifications. .

B. Faceplates shall be available for the following applications:

1. Furniture Faceplates.
2. Standard Faceplates.
3. Wall Phone Faceplates.

C. Acceptable manufacturers:

1. Panduit Minicom

2.05 PATCH CORDS

A. Contractor shall provide Category 6A patch cords for the following areas to the Client representative at such time as required for the client installation of network and/or workstation equipment. Refer to drawings for quantities, category(ies), and colors of patch cords required at each area.

1. Work Areas - work area cables for each work area faceplate.. The work area cables are intended to connect workstation devices (PC, printer, etc.) to the telecommunications outlets at the work area faceplate.
2. Telecommunications Room - TR patch cables for each work area faceplate. These patch cords are intended to connect patch panels or telecommunication outlets in the Telecommunications Room to the network equipment (hubs, switches, etc.) also located in the Telecommunications Room.
3. Computer Room/Data Center Patch Cords - Equipment cables. The equipment cables are intended to connect client equipment (servers, routers, etc.) to the network in the Computer Room/Data Center, Telecommunications Room and other Equipment Rooms.

B. Contractor shall provide a schedule of all patch cords including quantity, colors and lengths with submittals for review and approval prior to ordering.

C. Requirement for installation of patch cords is noted on drawings, and may vary by area.

D. Contractor shall verify with the owner regarding patch cord procurement. All patch cords shall be Owner-Furnished, Contractor-Installed (OFCI) unless otherwise direected by the client.

2.06 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with ANSI/TIA-607-D.

2.07 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

C. Comply with ANSI/TIA-607-D.

2.08 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA-606-C and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with Cornell Design & Construction Standards, Div. 27 for Labeling requirements.

C. Comply with requirements in Section 2760553 "Identification for Electrical Communications Systems."

PART 3 EXECUTION

3.01 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters[and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used]. Conceal pathways and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
3. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with ANSI/TIA-568.1-E.
2. Comply with BICSI ITSIM, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. MUTOA shall not be used as a cross-connect point.
5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
   a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
   b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIM, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568.2-D.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8-inches (200 mm) above ceilings by cable supports not more than [48-inches (1219 mm)] apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable [6-feet (1800 mm)] long not less than [12-inches (300 mm)] in diameter below each feed point.

F. Installation of Cable Routed in Wet Listed locations:

1. Install outdoor or outdoor/indoor rated cable only.
2. Cables must be transitioned from outdoor rated cabling to indoor rated cabling in a consolidation point or terminate on equipment within 50-feet of entering the building.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-E for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.03 FIRESTOPPING

A. Comply with requirements in Division 07 "Penetration Firestopping."

B. Comply with ANSI/TIA-569-E, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI/TIA--607-D.

C. Comply with Section 260526 “Grounding and Bonding for Electrical Systems”.

D. Comply with Section 270526 “Grounding and Bonding for Communications Systems”.

3.05 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Administration Class: [2] .
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
3. Comply with Cornell Design & Construction Standards, Div. 27 for Labeling requirements.

B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

C. Comply with requirements in Division 09 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-C for [Class 2] level of administration, including optional identification requirements of this standard.

E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, [backbone pathways and cables,] [entrance pathways and cables,] terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish electronic record of all drawings, in software and format selected by Owner.

G. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.
4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
5. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.1-E.
2. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.2-D. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. UTP Performance Tests:
    a. Test for each outlet and MUTOA. Perform the following tests according to ANSI/TIA-568.1-E and ANSI/TIA-568.2-D:
        1) Wire map.
        2) Length (physical vs. electrical, and length requirements).
        3) Insertion loss.
        4) Near-end crosstalk (NEXT) loss.
        5) Power sum near-end crosstalk (PSNEXT) loss.
        6) Equal-level far-end crosstalk (ELFEXT).
        7) Power sum equal-level far-end crosstalk (PSELFEXT).
        8) Return loss.
        9) Propagation delay.
        10) Delay skew.
6. Final Verification Tests: Perform verification tests for UTP[and optical fiber] systems after the complete communications cabling and workstation outlet/connectors are installed.
    a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
    b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.07 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for [two] years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within [two] years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide [30] days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500

SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Division 1 - All Sections;

B. Division 8 - Door Hardware;

C. Division 26 – Electrical for Raceways, Conduit and Power Interfaces;

D. Division 27 - Communications Cabling;

E. Division 28 – Conductors and Cables for Electronic Safety and Security

F. Division 28 - Section 281300 - Access Control;

G. Division 28 - Section 281600 - Intrusion Detection;

H. Division 28 - Section 282300 - Video Surveillance; and

1.02 APPLICABLE CODES AND STANDARDS

A. Intent: It is not the intent of this Section to provide all details of design and fabrication. The Contractor shall ensure that equipment has been designed and fabricated in accordance with applicable engineering codes and standards.

B. Current Standards: This Section is based on the latest codes and standards in force at the time the Specification is issued for bid. Should the standards and codes listed herein be revised before or after the award of the Contract, Contractor shall inform the Owner in writing immediately upon receipt of such information. Before adoption of any subsequent issue, Contractor shall identify the changes in writing and shall not proceed with engineering, material and/or fabrication changes without Owner's written permission.

C. Change in Standards: Owner reserves the right to impose the requirements of later revisions of the codes, regulations, standards, specifications, and addenda referenced herein. Resolution of the changes resulting from these revisions shall be mutually agreed upon by Contractor and Owner.

D. Standard Fees: Contractor shall be responsible for compliance with all U.S. federal and territorial codes, standards and all other Laws within the jurisdictions governing the Project site, as applicable to the extent of his Work. Further, Contractor shall pay all fees and obtain all necessary approvals from governing life-safety code and/or building codes authorities, which may include approval for variances or waivers, governing the security systems, equipment and devices, before ordering or purchasing any systems, equipment or materials, and before proceeding with any Work. Any problems related to obtaining approvals shall be promptly brought to the attention of the Owner.

E. List of Standards: Design, material, fabrication, testing, inspection, certification, documentation, and operation shall conform to the referenced codes, regulations, standards, specifications, and addenda listed below, as applicable.

1.03 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced and are intended to establish a level of performance. It is the responsibility of the Contractor to bring any conflicts to the attention of, or request clarifications of, the Owner prior to the start of work. The publications are referred to in the text by the basic designation only. Where standards and publications are identified, they shall be the most current version.

1. American National Standards Institute (ANSI) Publications:
   a. National Electrical Safety Code
      1) ANSI/NEMA Performance Standard for Cat 6 & 7 100 Ohm Shielded and Unshielded Twisted Pair Cables
      2) Additional Controls for Use by American National Standard Code for Information Exchange
      3) Data Encryption Standard
      4) Office Machines & Supplies - Alphanumeric Machines / Keyboard Arrangement
2. American Society for Testing and Materials (ASTM) Publications:
      1) Standard Practice for Security Engineering Symbols
3. Building Officials & Code Administrators (BOCA) International, Inc.:
      1) The BOCA National Building Code, Fourteenth edition, 1999
4. Communications Specific:
      1) ANSI/TIA-568.0-D: Generic Telecommunications Cabling for Customer Premises.
      2) ANSI/TIA-568.1-D: Commercial Building Telecommunications Infrastructure Standard
      3) ANSI/TIA-568-2.D: Balanced Twisted Pair Telecommunications Cabling and Components Standards
      4) ANSI/TIA-569-D: Telecommunications Pathways and Spaces
      5) ANSI/TIA-606-C: Administration Standard for Telecommunications Infrastructure
      6) ANSI/TIA-607-C: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
      7) ANSI/TIA-942-B: Telecommunications Infrastructure Standard for Data Centers
      8) ANSI/TIA-4966: Telecommunications Infrastructure Standard for Educational Facilities
      9) TIA: Technical Service Bulletins (TSBs) (related to the above ANSI/TIA standards)
      10) NEC: NFPA 70
      11) Radio Frequency Devices
      12) Rules and Regulations
5. Institute of Electrical and Electronics Engineers (IEEE)
      1) Surge Voltages in Low Voltage AC Power Circuits

2) Standard Dictionary of Electrical and Electronics terms
3) Recommended Practice for Grounding of Industrial and Commercial Power Systems

6. International Organization for Standardization (ISO) Publications:
   1) Identification Cards - Physical Characteristics
   2) Identification Cards - Integrated Circuit(s) Cards with Contacts
   3) Quality Management Systems - Requirements (formerly ISO 9001)
   4) Identification Cards - Contactless Integrated Circuit(s) Cards - Proximity Cards
   5) Identification Cards - Contactless Integrated Circuit(s) Cards - Vicinity Cards
7. National Fire Protection Association (NFPA) Publications:
   1) National Electrical Code
   2) Life Safety Code (Chapter 5 - 1997)
8. National Electrical Manufacturers Association (NEMA) Publications:
   1) Industrial Controls and Systems
   2) Industrial Control Devices and Assemblies
   3) Enclosures for Industrial Controls and Systems
   4) Enclosures for Industrial Controls and Systems
   5) Enclosures for Electrical Equipment
9. Underwriters Laboratories, Inc., Standard for Safety:
   1) Surface Metal Raceways and Fittings
   2) Rigid Metal Conduit
   3) Cabinets and Boxes
   4) Electric Wired Cabinets
   5) Thermoplastic-Insulated Wires
   6) Lightning Protection Components
   7) Fuses
   8) Access Control System Units
   9) Key Locks
   10) Communication Cables
   11) Wire Connectors and Soldering Lugs
   12) Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
   13) Protectors for Data Communication and Fire Alarm Circuits
   14) Fuse Holders
   15) Boxes, Metallic Outlet
   16) Boxes, Fittings for Conduit and Outlets
   17) Power Supplies For Use with Burglar-Alarm Systems
   18) Local Burglar-Alarm Units and Systems
   19) Central-Station Burglar-Alarm Systems
   20) Electrically Actuated Transmitters
   21) Connectors and Switches For Use With Burglar-Alarm Systems
   22) Intrusion Detection Units
   23) Conduit, Schedule 40 and 80 Rigid PVC

24) Conduit, Type EB and A Rigid PVC and HDPE Conduit
25) Installation and Clarification of Burglar and Hold Up Alarm Systems
26) Electrical Printed Wiring Boards
27) Electrical Metallic Tubing
28) Central Stations For Watchman, Fire-Alarm, and Supervisory Services
29) Anti-Theft Alarms and Devices
30) Proprietary Burglar Alarm Units and Systems
31) Boxes, Termination
32) Standard for Safety for Information Technology Equipment

10. Applicable federal, state and local laws, regulations, ordinances, and codes.

B. Conflicts: In the event of conflicting requirements between the authorities cited above or between authorities cited and those specified, such disagreements shall be resolved by the Owner.

C. Compliance: Nothing in this Section, including revocation of certain specific codes, standards, or specifications, shall relieve the Contractor of the responsibility for compliance with the codes, standards or specifications that are generally recognized to be applicable to the Work specified herein.

D. The referenced codes establish a minimum level of requirements. Where provision of the various codes conflict with each other, the more stringent provision shall govern. If any conflict occurs between referenced codes and this specification, the codes are to govern. Compliance with code requirements shall not be construed as relieving the Contractor from complying with any requirements of the drawings or specifications which may be in excess of requirements of the governing codes and rules and not contrary to same.

E. Obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. Arrange for inspection of work by the inspectors and give the inspectors all necessary assistance in their work of inspection.

1.04 DEFINITIONS

A. General: The following definitions are applicable to electronic security work within Division 27 and 28. Conflicts between these definitions and any other definitions presented within any Contract Document, as well as inquiries about the intent or meaning of definitions, shall be promptly brought to the attention of the Owner. Should conflicts exist between these definitions and the definitions found in the project General Conditions, the more stringent definition shall govern.

1. Acceptable Manufacturer: Where this term is used it is intended to denote specific manufacturers qualified to provide the products specified.
2. General Contractor: The General Contractor is the company, and/or its duly appointed representative, which/who has responsible charge of the construction portion of the Project.

3. Security Contractor: This term designates the company which conducts the Work and is responsible to ensure that others provide specified Work as described in the Specifications for security systems within Division 26, 27, 28 and other related Divisions and Sections of the Specification. This term specifically refers to a company that is qualified to perform the Work specified herein related to the integration of all electronic security access control and surveillance systems and components and the fabrication and installation of all security equipment. The term "Security Contractor" used herein shall be understood to be synonymous with trade "Contractor."
4. Test: "Test" implies the systematic exercising of an item or system under all specified conditions with quantitative measurement of specified parameters and comparison of performance against the quantitative standards set forth.

1.05 SUMMARY OF WORK

A. Subcontracted Work/Security Contractor:

1. The Security Contractor shall be responsible for the Work cited herein.
2. The Security Contractor shall be a specialist in and shall be primarily engaged in furnishing, fabricating and installing security equipment specified herein. Further, the Security Contractor shall be a specialist in and shall be primarily engaged in furnishing, fabricating and installing electronic security access control and monitoring systems for facilities as specified herein. Contractor must meet the minimum qualifications specified in the IFB front end documents.
3. A single firm shall be responsible for all electronic security access control systems integration Work. Security Contractor may subcontract portions of its responsibilities for electronic systems integration, but approval of the second-tier subcontractor to the Security Contractor shall be required from the Owner. The second-tier subcontractor, if any, shall meet qualification requirements identical to those required of the first-tier subcontractor. Further, the second-tier subcontractor, if any, shall be transparent to the Owner with respect to coordination, submittals, and all other project-related communications. The intent of this requirement is that the Owner. has a fully qualified, single-point-of-contact with respect to the security Work specified within Division 28 and 26. At Owner's option, preference may be given to a single firm that can provide all Work specified herein.

B. Scope of the Work includes furnishing and installing the following:

1. The Security Contractor's Work shall include the furnishing and installation of security systems, equipment and materials described by the Specification, but in particular by pertinent sections within Division 28 and 26 of the Specification, as well as Drawings attendant to Division 28 and 26.
2. A fully integrated security system shall be installed, documented and tested, satisfactory to the Owner.
3. The integrated security system shall include:
   a. Access Control and Monitoring systems, duress / panic alarms;
   b. Video Surveillance System;
   c. Intrusion Detection Security System Controller, Power Supplies, and field devices

4. The scope of the project shall include line supervision of all communication circuits between the operator consoles, control stations, local panels, and remote sensors. The Work shall include the furnishing and installation of security system components, interconnecting conductors, fiber optic and coaxial cabling (if required), termination of security system signals and communications, power distribution, interconnecting conduits and raceways, and the testing of all integrated system components, including those furnished by Others which become part of the integrated system (except for the conductors/cables associated with high voltage power, which will be furnished, installed and terminated by the Electrical Contractor). Security Contractor shall furnish and install all other security system interconnecting wires and/or fiber optic cabling.
5. Associated installation support, including the furnishing and installing of conduits, junction boxes, primary electrical power feeds and cables, associated raceways, and electrical distribution panels, shall be provided by the Electrical Contractor. Conductors shall be clearly marked and shall be terminated onto terminal strips in termination cabinets. Security Contractor shall furnish and install all other security system interconnecting conduits, junction boxes, outlet boxes, and electrical troughs. Security conduits shall be installed with a nylon pull string inside for the installation of interconnecting conductors. All conduits containing fiber optic cabling shall be installed with innerducts.

C. Major Responsibilities of Security Contractor and Coordination With Other Trades:

1. The Security Contractor shall study the entire Specification, both written and illustrated, of the entire Project. Conflicts, if any, must be immediately brought to the attention of the Owner prior to the start of Work. The Security Contractor shall examine the Drawings and Specifications of other trades whose work may influence the installation of the security systems. The Security Contractor shall include in his bid all services attributed to coordinating the installation of the security system with the Work of other trades. Prior to the start of Work, the Security Contractor shall review the Project Drawings and Specifications and shall coordinate his Work with that of the Electrical Contractor and other trades. In particular, the Security Contractor shall coordinate such Work as, including but not limited to, the following:
   a. AC power feeds;
   b. electric power distribution panels;
   c. wiring and conductors;
   d. fiber optic outdoor cable plant;
   e. conduit and raceway systems;
   f. junction boxes, back boxes and enclosures; and
   g. terminations for supply of power for the security system components.
   h. Questions shall be promptly submitted to the Owner as Requests for Information (RFIs).
2. Special attention is called to the following items. Coordinate all conflicts prior to installation:
   a. Location of grilles, pipes, sprinkler heads, ducts and other mechanical equipment so that all communications outlets and equipment are clear from and in proper relation to these items.
   b. Location of cabinets, counters and doors so that communications outlets, and equipment are clear from and in proper relation to these items.
   c. Recessing and concealing communications materials in CMU walls, concrete construction and precast construction.

d. In every telecommunication room with either active or passive equipment the Contractor shall monitor the work of all trades to assure that the space and clearance requirements of code are met.

3. The Electrical Contractor shall furnish and install certain power distribution and supply panels, wiring, conductors, conduits, junction boxes, and terminations for the supply of 120VAC power to security system components as indicated on the Drawings. It shall be the responsibility of the Security Contractor to provide the Electrical Contractor with complete information regarding 120VAC requirements, including 120VAC distribution and supply panels and terminations, and information for all security conduit and backboxes. The Security Contractor shall provide UPS units.
4. The Security Contractor shall furnish and install all Division 28 low voltage security systems interconnecting electrical conductors. The Security Contractor shall clearly mark all conductors and shall make all connections in accordance with the NEC.
5. The Security Contractor shall provide and test all fiber optic cable within and between buildings and all perimeter site equipment locations. Refer to Communications Backbone Cabling Section for all fiber optic cabling requirements. All terminations, connectors and fiber optic transmitters, receivers, and transceivers required as part of Division 28 security systems shall be provided by the Security Contractor.

D. Signage: The Security Contractor shall fabricate and install signage required by security systems. The Owner shall be requested by the Security Contractor to approve proposed signage.

E. Exceptions: The Security Contractor shall specifically state in his proposal any exceptions made to the Drawings and Specification. Unless such exceptions are specifically stated and accepted in writing by the Owner, it shall be the responsibility of the Security Contractor to comply with all the Drawings, Specifications and referenced standards and guidelines.

F. The Security Contractor shall obtain all required Permits and Inspections required by the local AHJ. The Security Contractor is responsible for all associated cost and scheduling of the inspections. The Security Contractor shall coordinate all permitting with the Owner.

1.06 SECURITY CONTRACTOR QUALIFICATIONS

A. Must be certified by the appropreiagte manufacture.

1.07 MATERIAL AND WORKMANSHIP

A. General: Unless otherwise specifically provided in this Contract, all equipment, material and articles to be incorporated in the Work shall be new and of the most suitable grade for the purpose intended. Unless stated otherwise, reference to any equipment, material, article or patented process in the Specifications, by trade name, make or catalog number shall be regarded as establishing a standard of performance and quality.

B. Submitted Materials: The Security Contractor shall furnish to the Owner for his acceptance the name of the manufacturer, the model number and other identifying data and information respecting the performance, capacity, nature and rating of the electrical, mechanical and other equipment that the Security Contractor contemplates incorporating in the Work. When required by this Contract or when called for by the Owner, the Security Contractor shall furnish to the Owner for his acceptance full information concerning the material or articles that he contemplates incorporating in the Work.

C. Samples: When so directed, samples shall be submitted for approval at the Security Contractor's expense, with all shipping charges prepaid.

1. Unapproved Materials: Equipment, material and articles procured, installed, or used without required approval shall be at the risk of subsequent rejection. Warranties of all Work and installed products shall be in accordance with the Contract General Provisions and as cited herein.

1.08 QUALITY ASSURANCE

A. General: Required inspection and testing services are intended to assist the Owner in the determination of probable compliance of the Work with requirements specified or indicated. These required services do not relieve the Contractor of responsibility for compliance with these requirements or for compliance with requirements of the Contract Documents.

B. Definitions:

1. Quality control services include inspections and tests and related actions including reports performed by independent agencies (if required by the Owner) and governing authorities, as well as directly by the Contractor. These services do not include Contract enforcement activities performed directly by the Owner.
2. Specific quality control requirements for individual units of Work are specified in the sections of these specifications that specify the individual element of the Work. These requirements, including inspections and tests, cover both production of standard products, and fabrication of customized Work. These requirements also cover quality control of the installation procedures.
3. Inspections, tests and related actions specified in this section and elsewhere in the Contract Documents are not intended to limit the Contractor's own quality control procedures, which facilitate overall compliance with requirements of the Contract Documents. Requirements for the Contractor to provide quality control services by the Owner, governing authorities or other authorized entities are not limited by the provisions of this Section.

C. Quality Control: When the Contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless the Owner authorizes others.

1. If the Contractor desires to use a method or type of equipment other than specified in the Contract, Contractor may request authority from the Owner to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing Work in conformity with the Contract Documents.

2. If, after trial use of the substituted methods or equipment, the Owner determines that the Work produced does not meet Contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining Work with the specified methods and equipment.
3. The Contractor shall remove all deficient Work and replace it with Work of specified quality, or take such other corrective action as the Owner may direct. No change will be made in the Contract Sum or in Contract Time as a result of authorizing a change in methods or equipment under this subsection.

D. Source of Supply and Quality Requirements: The materials used on the Work shall conform to the requirements of the Contract Documents. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed). Modifications to existing materials shall be done in accordance with manufacturer's recommendations and/or the Drawings.

1. In order to expedite the inspection and testing of materials, and if requested by the Owner, the Contractor shall furnish complete statements to the Owner as to the origin, composition, and manufacture of all materials to be used in the Work. Such statements shall be furnished promptly after execution of the Contract but in all cases, prior to delivery of such materials.
2. At the Owner's option, materials may be approved at the source of supply before delivery is stated. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

E. Tests and Cited Specifications: All materials used in the Work will be inspected and tested by the Contractor as approved by the Owner before incorporation in the Work. Any Work in which untested materials are used without approval or written permission of the Owner shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the Owner, shall be removed at the Contractor's expense. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the Work.

F. Certification of Compliance: The Owner may permit the use, prior to inspection and testing, of certain materials or assemblies when accompanied by manufacturer's certificates of compliance stating that such materials or assemblies fully comply with the requirements of the Contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the site must be accompanied by a Certificate of Compliance in which the lot is clearly identified.

1. Materials or assemblies used on the basis of Certificates of Compliance may be sampled and tested at any time and, if found not to be in conformity with Contract requirements, will be subject to rejection whether in place or not.
2. The form and distribution of Certificates of Compliance shall be as approved by the Owner.
3. When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "brand name," the Contractor shall be required to furnish the manufacturer's Certificate of Compliance for each lot of such material or assembly delivered to the Work. Such Certificate of Compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and
b. Suitability of the material or assembly for the use intended in the Contract Work.

4. Should the Contractor propose to furnish an "or equal" material or assembly, Contractor shall furnish the manufacturer's certificates of compliance as hereinbefore described for the specified brand name material or assembly. However, the Owner shall be the sole judge as to whether the proposed "or equal" is suitable for use in the Work.
5. The Owner reserves the right to refuse permission for use of materials or assemblies on the basis of Certificates of Compliance.

G. Storage of Materials: Materials shall be so stored as to assure the preservation of their quality and fitness for the Work. Stored materials, even though approved before storage, may again be inspected prior to their use in the Work. Stored materials shall be located so as to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the Owner. Materials to be stored on site shall not create an obstruction to construction activities.

H. Unacceptable Materials: Any material or assembly that does not conform to the requirements of the Contract Documents shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the Site of the Work, unless otherwise instructed by the Owner. Rejected material(s) or assembly (lies) that have been corrected by the Contractor shall not be returned to the Site of the Work until such time as the Owner has approved its use in the Work.

I. Coordination: The Contractor shall coordinate with each independent agency engaged to perform inspections, tests and similar services for the Project and shall coordinate the sequence of activities so as to accommodate required services with a minimum of delay in the progress of the Work. In addition, the Contractor shall coordinate the Work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, and similar activities. The testing shall not be used as justification for claims for extension of Contract Time.

J. Inspection of Conditions: Contractor shall require the installer of each major unit of Work to inspect the field conditions under which the Work is to be performed. The installer shall report all unsatisfactory conditions in writing to the Contractor. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the Contract Documents.

K. Inspection of Materials: Inspect each item of materials or equipment immediately prior to installation. Reject damaged and defective items. Provide attachment and connection devices and methods for securing Work. Secure Work true to line and level, and within recognized industry tolerances. Refer questionable visual-effect choices to the Owner for final decision. Recheck measurements and dimensions of the Work, as an integral step of starting each installation. Install each unit of Work during weather conditions and project status, which will insure the best possible results in coordination with the entire Work. Coordinate enclosure of the Work with required inspections and tests, so as to minimize the necessity of uncovering Work for that purpose. Where mounting heights are not indicated, mount individual units of Work at industry recognized standard-mounting heights for the particular application indicated. Refer questionable mounting height choices to the Owner for final decision.

1.09 MANUFACTURERS' REPRESENTATIVES

A. The services of a qualified manufacturer's technical representative, thoroughly experienced in the installation and operation of the type of system being provided under this Contract and with no less than ten (10) continuous years of technical experience as manufacturer's representative, shall be obtained by the Security Contractor, at his own expense, to consult on equipment selection, installation, and testing of the specified systems if and as requested by the Owner.

1.10 PRE-SECURITY INSTALLATION MEETING

A. Prior to completion of required submittals, the Contractor shall meet with the Owner, General Contractor, and other interested parties collectively to review proposed equipment, interfaces with all associated systems, and coordination with other related Sections. Any conflicts, concerns or inquiries shall be conveyed at this time.

1.11 SUBMITTALS

A. General: Comply with requirements of this section and all other relative sections.

B. Quality Assurance (QA) Plan: The Security Contractor shall provide a plan to the Owner for approval for a quality assurance program. This plan shall describe the inspection and verification methods to be used by the Security Contractor to ensure all work, materials, and equipment (to include installation) conform to the requirements specified herein. In addition, the plan shall contain a project schedule with anticipated milestone dates for all project related tasks (i.e. product data and shop drawing submittals, various construction milestones, testing, acceptance, etc.).

C. Materials and Equipment List: Within 45 days after award of contract, the security contractor shall submit for approval, a complete list of all materials, equipment and accessories proposed for his Work in accordance with these Specifications and Contract Drawings. This list shall include manufacturers, complete catalog identification numbers and model or system designator, quantities, options, catalog "cuts", basic system architecture block diagrams, and CPU software operating features (where applicable). The submittal shall be in sufficient detail whereby the Owner can readily identify the equipment and materials proposed. Catalog cut-sheets shall clearly identify which model or features are being proposed. No consideration will be given to partial lists or lists submitted from time-to-time. Approval of materials and equipment will be tentative to the submission of complete shop drawings. The Owner shall not be obligated in any manner for any materials, equipment or accessories that have not been accepted by the Owner.

1. Collect product data into a single submittal for each element of construction or subsystem and submit at one time. Product data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, standard wiring diagrams, controls and performance curves. Where product data must be specially prepared or modified because standard printed data is not suitable for use, submit as "Shop Drawings".
2. Clearly mark each copy to identify pertinent products, models, features, and accessories. Show performance characteristics and capacities. Show dimensions and clearances required. At a minimum, include the following information:

a. Manufacturer's printed recommendations.
b. Compliance with recognized trade association standards.
c. Compliance with recognized testing agency standards.
d. Application of testing agency labels and seals.
e. Notation of dimensions verified by field measurement.
f. Notation of coordination requirements.

3. Do not submit product data until compliance with requirements of the Contract Documents has been confirmed by the Contractor.

D. Shop Drawings: After receiving acceptance from Owner of the product data submittals, and tentative acceptance of the materials and equipment lists, and before ordering, purchasing, fabricating or installing any materials or equipment, the Security Contractor shall submit shop drawings of the systems to demonstrate compliance with the Contract Documents. The shop drawings shall be submitted at one time. No consideration will be given to partial submittals. If departures from the shop drawings are subsequently deemed necessary by the Security Contractor, details of such departures, as well as relevant details not represented in Contract Drawings, including changes in related portions of the project, and the reasons therefore, shall be submitted in writing or on drawings to the Owner for approval prior to fabrication or the start of any Work.

1. The Security Contractor shall prepare and submit shop drawings to the Owner for approval, indicating fabrication and installation details. The submission must be made sufficiently in advance to allow time for review and return by the Owner and their consultants. No extension of the contract time will be granted for failure to allow sufficient time for review and processing.
2. Shop drawings shall be in the form of computer-generated drawings (AutoCAD 2016 or newer version), accurately scaled, showing methods of fabrication, system architecture, interconnection and wiring diagrams, schematics, schedules, wire and conduit types and sizes, installation and equipment locations, and details of installation, as well as all field-verified (by the Security Contractor) conditions and dimensions necessary for satisfactory installation. Free-hand sketches or reproductions of the Contract Drawings will not be accepted.
3. Where custom components are to be used, drawings and functional specifications shall be provided to the Owner for inspection and approval prior to fabrication and installation.
4. Submittals shall include equipment load and standby power sizing calculations used by the system equipment submitted by the Security Contractor for approval. Calculations shall support compliance with minimum power standby requirements specified herein.
5. Prior to installation, the Security Contractor shall prepare layout drawings indicating exact location of cameras and their field of coverage. Drawings shall indicate obstructions such as light fixtures, signage, piping, and/or ductwork.
6. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of shop drawings.
7. Shop drawings will be reviewed for general conformance with the design concepts. Apparent dimensional and quantitative discrepancies observed during the Owner's review will be noted for the Security Contractor's convenience only and should not be accepted as correct or complete or in any way understood to modify the Security Contractor's responsibilities as a part of this Contract.

8. Shop drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, schedule, or room/space numbers shown on the Contract Drawings.
9. Do not use Shop Drawings without Owner's appropriate final stamp indicating action taken in connection with construction.
10. Submittal Scope of Detail: The shop drawing submittals shall include highly detailed, to-scale, computer-generated drawings describing the products (systems, equipment, devices and materials) and Security Contractor's services as to precise locations, mounting and installation methods, details and dimensions, schedules, conduit sizing, conduit routing, riser diagrams, point-to-point interconnect diagrams, equipment schedules, zoning schedule, door schedules, window schedules, camera schedules, system interface schedules or diagrams, power requirement schedules, stand-by/emergency power schedule, manufacturers' catalog sheets (cuts), cost reports, and such other diagrammatic or written descriptions which shall allow the Owner to thoroughly and accurately understand the security systems and equipment that are being furnished, how they are intended to function, how they will be installed, and all other necessary information of similar intent.
11. Shop Drawings shall indicate, among other requirements noted herein, the precise locations of all conduit, raceway, junction and utility boxes, termination panels, transformers (if any), power supplies, panels, and all other equipment noted.
12. Shop drawings shall clearly illustrate all mounting locations and methods, with particular detail for the installation of card readers and all other associated devices, and the mounting of interior and exterior video cameras. While some drawing details may be "typical," the shop drawings shall illustrate the installation detail of each unique application.
13. Security door and equipment schedules and details shall provide the following information, as, and if, appropriate in each case:
    a. Door/gate name or number;
    b. Door/gate type;
    c. Closed status sensor;
    d. Locked status sensor;
    e. Lock type;
    f. Audible/visual annunciation type;
    g. Power requirements;
    h. Emergency power;
    i. Access control type;
    j. Special installation requirements;
    k. Timed-shunt times;
    l. Shunt type;
    m. Precise, to-scale mounting location;
    n. Zone or point designation;
    o. Equipment room connectivity;
    p. Remote control of lock by specific and designated control location(s);
    q. Video camera number activated by sensor or switch closure;
    r. Input/output programming schedules; and
    s. Cpu output reports structure.

14. Camera schedules and details shall provide the following information, as, and if, appropriate in each case:
    a. Camera number;
    b. Camera type;
    c. Monitor number for each camera;
    d. Alphanumeric title to be displayed on monitor (as reviewed and approved by the owner)
    e. Sequencing [if any];
    f. Camera manufacturer's model number;
    g. Camera features, such as auto-iris and auto-focus;
    h. Lens specification;
    i. Power requirements;
    j. Type of power input;
    k. Cable type;
    l. Length of cable run;
    m. Mounting height;
    n. Camera mounts;
    o. Camera housing;
    p. Camera housing features, such as heater, blower, sunshield, etc.;
    q. Camera drives;
    r. Switcher position;
    s. Switcher type;
    t. Monitor type;
    u. Cameras displayed on each monitor, especially linked displays;
    v. Video recording settings;
    w. Alarm queuing;
    x. Special installation or carpentry requirements;
    y. Camera and/or lens controls;
    z. Equipment room connectivity;
    aa. Alarm homing;
    bb. Termination method; and
    cc. Lightning, ground loop, etc. Protection.
15. Additionally, the shop drawings shall clearly illustrate the fields of view of each camera in plan view, as well as "park" positions for panning and zooming cameras. If the camera is capable of wide-angle and telephoto viewing, both fields of view shall be indicated. The installer's "aiming point" shall be indicated. The Security Contractor's submittal shall clearly identify outdoor video cameras mounting details and maintenance access concepts and design.
16. System interface schedules or diagrams shall clearly identify:
    a. Sensors and switches which queue video cameras, as well as the number of camera activated;
    b. Video recording activation logic;
    c. Video monitor switching logic;

d. Interfaces between the access control system and other subsystems;
e. Distributed processing capabilities and functions; and
f. Sensors and switches exclusively used as request-to-exit devices.

E. Spare Parts and Components List: At the conclusion of the Security Contractor's Work, the Contractor shall provide to the Owner spare parts, complete list of manufacturers' recommended spare parts and components required in order to satisfactorily maintain and service the systems for a minimum of two (2) years. The amount of spare parts shall equal 10% of the total number of each component installed. Backbone and horizontal cabling are not included in the spare parts requirements.

F. Operation, Maintenance, and Service Manuals: Prior to final acceptance, complete sets of operation, maintenance and service manuals shall be submitted for systems and equipment provided under this contract. The manuals shall be compiled, assembled and indexed, in an easily identifiable hardcover form. The manuals shall be submitted to the Owner prior to final acceptance testing. The manuals shall include the following:

1. Table of contents;
2. An index for quick references to name, mailing address, website, and telephone number for service for each item of equipment or system;
3. Complete operating instructions;
4. Complete maintenance instructions, wiring diagrams, and troubleshooting instructions;
5. System service instructions for work which manufacturers recommend user service;
6. Complete parts lists for each major item of equipment and/or for each system;
7. Complete collection of manufacturers' product and catalog literature for equipment and systems installed under this contract;
8. Manufacturers' warranties;
9. Operating characteristics, performance data, ratings, and manufacturers' specifications for each item of equipment or system;
10. Where practical, internal wiring diagrams and schematics; and
11. Software User Documentation including operating instructions, programming instructions, technical documentation and maintenance procedures to permit making changes to system configuration, time changes, etc.

G. As-Built Drawings: Security Contractor shall provide, and keep up-to-date, a complete record set of red-lined drawings, which shall be corrected and shall show every change from the original Specifications and Contract Drawings through final acceptance. The record set of drawings shall be protected against soiling, tears, and similar damage and defacement. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Security Contractor to make changes in the Work without proper approvals. Upon completion of his Work and before final payment, the Security Contractor shall submit the complete record set to the Owner for review. Upon acceptance, the record set shall be retained by the Owner. As-built drawings will be kept up-to-date and will be checked monthly as a requirement for approval of monthly progress payments to Contractor.

H. Record Drawings: At the conclusion of this project, a complete set of drawings and a copy of the drawing files of all the Security Contractor's drawings specifically prepared for this Contract shall be provided to the Owner on CD ROM formatted for use by AutoCAD 2016 or higher. The drawings shall be computer-generated and shall contain all changes shown in the record set. Hand-drawn sketches, changes or red-line markups are not acceptable.

I. Formal Test Plan and Procedures: At least 45 days prior to acceptance testing and final inspection, the Security Contractor shall provide a formal test plan and test procedures submittal for the Owner's review. Refer to TESTS AND VERIFICATIONS portion of this Section for more details.

J. Additional Submittals: In addition to the submittals described above, other required submittals described in this and other Sections of the Specification must be presented and approved prior to final acceptance.

1.12 SUBMITTAL PROCEDURES

A. General: All submittals shall comply with the requirements of this section and all other relative sections.

B. Coordination: Coordinate each submittal with requirements of the Work and of the Contract Documents. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

C. Prior Review: Contractor shall indicate His prior review of the submittal by stamping the drawings, product data or cover sheet for submittal of samples. Stamps must be certified by the Contractor's signature or initials. Any changes in the submittals must be accompanied by a change order following appropriate procedures described in the General Requirements.

D. Cover Sheet: Every submittal shall be accompanied by a cover sheet containing the following:

1. Specification section number;
2. Specification name;
3. Submittal number;
4. Date of submittal;
5. Revision number (if re-submitted);
6. Brief description explaining the contents of the submittal;
7. Reason for re-submission (if re-submitted);
8. Modifications made since prior submittal (if re-submitted); and
9. List of deviations from the Specifications, Drawings, design intent, or submittal requirements and an explanation for the deviation, if any.

E. Incomplete Submittals: Submittals shall be returned without review if the submittal is incorrectly prepared, unstamped or is incomplete. Extensions of time will not be granted for improperly submitted Work. It is especially essential that all submittals are complete.

1.13 MAINTENANCE SUPPORT

A. The Security Contractor shall be capable of providing, or arranging for under a firm contractual basis, all on-going repair, scheduled maintenance, and warranty repair and maintenance support to the Owner for the installed systems on a year-round basis. [Note: This is in addition to the mandatory one-year warranty and repair service required in the base bid by the Specification.] Repair or maintenance services shall be available via telephone within one (1) hour and on site within four (4) hours upon a call by the Owner. The Security Contractor shall submit cost proposals for one-year and five-year additional maintenance and service agreements for all security equipment furnished within Division 28. Except for base bid warranty-related repair and maintenance, other repair and maintenance services shall be separately negotiated with the Owner.

1.14 PRICING PRACTICES

A. The Security Contractor shall be guided by fair mark-up pricing of equipment and labor. The Security Contractor shall be required to "break-out" specific costs from his total cost proposal. This breakout shall be in five (5) categories: quantities, units, labor cost per unit, total labor cost, and equipment cost. Totals shall be provided. Equipment shall be identified by manufacturer's name and model number. The factors used to "mark-up" for profit, overhead, general costs, administrative costs, and similar increases, shall be identified.

1.15 TRAINING

A. The Security Contractor shall provide a minimum of 2 day (16 hours) of on-site training. The Security Contractor shall provide all training materials (users manuals, licenses, site specific information, maintenance and operations manuals, etc.) for up to ten (10) people designated by the Owner. The Security Contractor shall coordinate and schedule the training well in advance.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. General: Except as otherwise specified, equipment and materials furnished shall be new, first grade, standard, current products of the manufacturer and shall be suitable for the systems being installed and the intent of the design.

B. Damaged Products: Any material, device or equipment damaged prior to or during installation and before acceptance of the completed system by the Owner shall be replaced, unless repairs can be made that are acceptable to the Owner. Any such replacement or repairs, including repairs to the finish, shall be made at no cost to the Owner.

C. Protection of Materials: Equipment and materials shall be properly stored, adequately protected and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored and protected in accordance with the manufacturers' recommendations. Equipment provided with a factory finish shall be maintained free of dust, dirt and foreign matter. Dents, marred finishes and other damage shall be repaired to its original condition or shall be replaced, at no additional cost to the Owner. The Contractor shall protect the Owner's and General Contractor's equipment and materials, as well as the Security Contractor's tools and materials, against theft and vandalism.

2.02 SECURITY SYSTEMS

A. Provide a complete and integrated system including the following subsystems:

1. Access Control, Alarm Monitoring and Duress / Panic Alarm System;
2. Video Surveillance System;
3. Intrusion Detection System; and
4. Low Voltage Power Distribution System.

2.03 INTEGRATED SYSTEM FUNCTIONAL REQUIREMENTS

A. Open Architecture: To the extent possible, all systems provided as part of the Work shall utilize open architecture. Systems proposed in the Bids that are based on open architecture will be looked upon more favorably than proprietary-based systems. Full integration of all security systems is required.

B. Access Control and Alarm Monitoring System: Provide a Security Management and Control System (SMCS) as defined in Section 28 13 00 - ACCESS CONTROL. The SMCS shall include, but not be limited to, intelligent distributed processors, power supplies, intrusion detection sensors, monitoring workstations, and network equipment as described herein.

C. Video Surveillance System: Provide a Network Video Recorders (NVR) and Video Management System (VMS) Software as defined in Section 28 23 00 - VIDEO SURVEILLANCE. The Video Surveillance System shall include, but not be limited to, video cameras, lenses, housings, mounts, monitors, VMS workstations, video encoders, video decoders, quad splitters, video recorders, power supplies, and network equipment as described herein.

D. Security Monitoring Stations: Provide equipment at remote security monitoring stations with components and accessories to control, process, integrate, and annunciate alarm signals from the security system from locations shown on the Drawings. Provide all hardware, software, licenses and installation as defined in the drawings and specifications

E. Low Voltage Power Distribution System: Provide a complete low voltage power distribution system for door locks and cameras as specified herein. Provide uninterruptible power supply (UPS) units and power distribution as specified herein and other sections of the Specifications.

2.04 INTEGRATED SYSTEM PERFORMANCE REQUIREMENTS

A. General: All systems specified herein shall operate as a complete integrated system. The Security Management and Control System shall provide centralized control. All other systems shall interface into this system.

B. Detection Coverage: Provide in-depth coverage and adjust sensors to provide coverage without mutual interference. Provide sensors and systems as detailed on the drawings.

C. Camera Coverage: Certain video cameras shall automatically cue-up upon activation of card readers, door position switches, intercoms, and/or other alarm inputs indicated on the Drawings. Pan-tilt-zoom cameras shall have alarm pre-set and home positions programmed into the system as indicated on the Drawings and approved by the Owner.

2.05 PRODUCT SELECTION

A. Provide products that comply with the Contract Documents and the following requirements:

1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
2. Like items shall be the same and shall be interchangeable.
3. For products specified by naming one or more manufacturers, submit a request for substitution for any manufacturer not specifically named.
4. For products specified by naming one or more manufacturer with a "no substitution" statement, substitutions are not allowed.
5. For products specified by performance requirements, provide products that comply with these requirements.
6. Where Specifications require matching or conforming to an established sample or quality standard or objective, the Owner's decision will be final on whether a proposed product or installation practice matches satisfactorily. Requirements for inconspicuous or concealed installation, as one example, establish such a standard and objective.

2.06 SUBSTITUTIONS

A. Time Limit: Only within 45 days after date of commencement will the Owner consider requests from Security Contractor for equipment substitutions. Subsequently, substitutions will be considered only when a product becomes unavailable due to no fault of Security Contractor. A change in the cost of a product does not constitute a reason for a substitution.

B. Compliance of Substitutions: Document each request for substitution with complete data substantiating compliance of proposed substitution with Contract Documents, including an itemized list of specification requirements and whether or not the proposed device/equipment is in compliance (compliance matrix or spreadsheet).

C. Criteria: By making requests for substitutions, the Security Contractor:

1. Represents that the Security Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
2. Represents that the Security Contractor will provide the same warranty for the substitution that the Security Contractor would have for the device/equipment specified.
3. Certifies that the cost data presented is complete and includes all related costs under this Contract except the Engineer's redesign costs, and waives all claims for additional costs related to the substitution(s) that subsequently become apparent.
4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

D. Separate Request for Substitutions: Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

E. Acceptance/Rejection Notification: The Owner will determine acceptability of proposed substitution(s), and will notify Security Contractor of acceptance or rejection in writing within a reasonable time.

F. Limited Substitutions: Only one request for substitution will be considered for each product. When substitution(s) is/are not accepted, provide specified product(s) or service(s).

2.07 ENVIRONMENTAL CONDITIONS

A. Interior Conditions: Equipment installed in environmentally protected interior areas shall meet performance requirements specified for the following ambient conditions:

1. Temperature: 40 to 105 degrees Fahrenheit. Components installed in unheated protected areas shall meet performance requirements for temperatures as low as zero (0) degrees Fahrenheit.
2. Relative humidity: 5% to 98%.

B. Exterior conditions: Equipment installed in all exterior locations shall be housed in weatherproof enclosures and/or mounts. All equipment mounted outdoors shall be provided with all necessary features and treatments, such as fans, blowers, vents, sunshields, etc., to create an environmental condition that allows all equipment to operate in accordance with the manufacturer's environmental specifications. All equipment shall be capable of satisfactorily performing outdoors in accordance with the manufacturer's specifications and instructions for temperatures between -20 degrees Fahrenheit and 120 degrees Fahrenheit and between relative humidity of 5% to 95%.

1. The equipment shall satisfactorily perform in heavy rain, pollen, dust, and ice conditions. The equipment and materials shall be protected against the effects of ultra-violet light from sunlight and against access by insects, mold, and fungus.
2. Exterior equipment shall be furnished and installed with substantial mounting hardware and enclosures to allow sustained equipment operation in lateral wind gusts of at least 150 miles per hour.
3. If the ambient temperature is commonly, consecutively or consistently above 95o degrees Fahrenheit, the Security Contractor shall provide and install an Exhaust Fan (with Filter Kit) or an Air Conditioning System. The Security Contractor shall verify with the Owner as to which method of cooling is required and at what NEMA rating desired prior to installation. Provide cooling method as specified herein and other sections of the Specifications and the contract drawings.

2.08 LIGHTNING & POWER SURGE PROTECTION

A. Protected Equipment: All Intrusion detection, alarm monitoring and access control, video circuitry, and communication circuits shall be protected at both ends against excessive voltages. This requirement shall apply for circuits that are routed both in underground conduits and overhead runs.

B. Protectors: As a minimum, both primary detection devices, such as three (3) electrode gas-type surge arrestors, and secondary protectors shall be installed to reduce dangerous voltages to levels that will cause no damage. Fuses shall not be permitted as lightning and power surge protection devices. Provide fail-safe gas tube type surge arrestors on all exposed security data circuits.

C. Performance: Breakdown voltage for the unit shall be 300 VDC to 500 VDC. The unit shall have equal performance for bi-polar operation with an automatic reset feature, and a minimum life of 1000 surges with ten (10) times 1000 microsecond waveform at 1000 amperes.

2.09 TAMPER PROVISIONS

A. General: Enclosures, cabinets, panels, housings, boxes, and fittings of every description having hinged doors or covers larger than 11"x11" that contain circuits of the security system and its power supplies, shall be provided with cover-operated corrosion-resistant tamper switches, arranged to initiate an alarm signal when the door is moved as little as one-quarter (1/4) inch from its normally closed position.

B. Mounting: Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened and removed.

C. Deactivation: The minimum amount of time required to depress or defeat the tamper switch after opening or removing the cover shall be greater than one (1) second.

D. Accessibility: Enclosure and tamper switch shall function in such a manner as to not allow direct line of sight to any internal components or the tampering of the switch or circuit wiring. Tamper switches shall be:

1. Inaccessible until the switch is activated;
2. Have mounting hardware concealed so that location of the switch cannot be observed from the exterior of the enclosure;
3. Be under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating;
4. Shall be spring-loaded and held in the closed position by the door protected; and
5. Shall be wired so that they break the circuit when the door is disturbed.

E. Security Screws: Covers to non-hinged enclosures smaller than 12"x12" that must be opened on a regular basis to make normal maintenance adjustments to the system and to service the power supplies shall be provided with security screws instead of tamper switches.

F. Junction Boxes: Covers of pull boxes and junction boxes installed during the initial installation of the system need not be provided with tamper switches. Exposed junction boxes in areas accessible to the public shall be avoided. Install junction boxes and other enclosures above ceilings or other locations that are not easily accessible. Where junction boxes must be installed in accessible areas, provide tamper resistant security screws.

2.10 SYSTEM ALARM ANNUNCIATION

A. General: System alarm annunciation shall include tamper, fail-safe, line fault, and power loss.

B. Tamper: Enclosures, cabinets, housings, boxes, raceways, and fittings having hinged doors or removable covers larger than 11"x11" that contain circuits of the intrusion detection system and its power supplies shall be provided with tamper switches.

C. Fail-Safe Alarms: Provide a fail-safe capability in all critical elements of the system. Fail-safe is defined as the capability to monitor for proper system functions and to report an alarm when a failure is detected in any critical system function. This shall include, but not be limited to, the capability to monitor communication link integrity and to provide self-test. When diminished functional capabilities are detected, the system shall provide annunciation of the fault. Fail-safe alarms shall be annunciated to clearly distinguish them from other types of alarms.

D. Fail-Safe Locking: All locking shall be fail-safe to the extent that such locking is required by appropriate and pertinent life-safety and building codes. Fail-safe locking shall be understood to mean that upon failure, locks shall fail in the "unlocked" and "unsecured" position. All required locking shall be interconnected into the building's fire alarm system and, upon activation of the fire alarm system, shall immediately "unlock" to permit emergency egress from the building. The Security Contractor shall coordinate all interface requirements with the fire alarm system installer. The Security Contractor shall furnish and install the necessary interface relays and interconnecting wiring, conduits, and mounting hardware, etc. to effect this operation.

E. Line Fault: As a minimum, fault isolation at the systems level shall have the same geographic resolution as provided for intrusion detection. The communication links of the security system shall have an active mode for line fault detection. Active mode is defined as that in which some type of signal is continuously sent across the link, resulting in simple link breaks being readily detected. The system shall be either a static system or a dynamic system. In a static system, the "no-alarm" condition shall always be represented by the same signal, which shall be different than the signal originally transmitted. The dynamic system shall represent "no-alarm" with a signal that continually changes with time.

F. Power Loss: Provide the capability to detect when any critical component of the system experiences loss of primary power and/or is switched over to either emergency power or uninterruptible power and to declare an alarm. The alarm shall be annunciated to clearly identify the component experiencing the power loss.

2.11 LINE SUPERVISION

A. Control: Communication interconnection lines between distributed control units and the central monitoring and control equipment shall be electrically supervised for both opens in the wiring and/or shorted wiring, and loss of data communication for all subsystems.

B. Remote Sensors: Interconnecting lines from input sensors and tamper switches shall remain under constant supervision during both SECURE and ACCESS modes and also shall be provided with electrical line supervision for both opens in the wiring and/or shorted wiring. Systems whose sensors are passive (transmit signals only for alarm conditions) shall also be provided with, or shall provide as an integral part of the sensor, line supervision between sensors and control units. The circuit shall be supervised by monitoring changes in the direct current that flows through the detection circuit and a terminating resistor. The supervision circuit shall initiate an alarm in response to a current change of ten percent (10%) or greater.

2.12 MATERIALS NOT LISTED

A. Furnish all necessary hardware, materials, and supporting equipment required to place in full operation the specified major subsystems. Some supporting equipment, materials, and hardware may not be described in the Contract Drawings and may not be identified herein. Depending on the manufacturers selected by the Security Contractor, some equipment, materials, and hardware may not be contained in either the Contract Drawings or these written Specifications, but are required by the manufacturer for full and complete operation in accordance with the intent of the design and these Specifications. In such cases, the Owner shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The Owner shall be consulted in the event that there is any question as to which supporting equipment, materials or hardware are intended to be included.

2.13 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new and free of any defects.

2.14 WARRANTY

A. Written Guarantee: The Security Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the Owner certifying that all the contract requirements have been completed in accordance with the final Specifications and Contract Drawings and warranting all materials and equipment furnished by the Security Contractor under this contract to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this Work excepted) for a period of one (1) year from the date of final acceptance or beneficial occupancy, whichever is later. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay to the Owner's satisfaction at the Security Contractor's expense.

B. Software: Contractor shall honor all factory service agreements provided as part of any software installed as part of the Work. In the event any software does not include a minimum one year factory service agreement, the Contractor shall obtain one year service agreements at his own expense. During the warranty period, the Contractor shall load all software or firmware updates and patches for any software provided as part of the Work as soon as available from the manufacturer.

C. Response: Repair or maintenance services during the warranty period shall be available via telephone within one (1) hour and on site within four (4) hours upon a call by the Owner. Contractor shall agree to these criteria in writing prior to the start of the mandatory one-year warranty period.

D. Periodic Inspections: The Security Contractor shall provide for four (4) periodic inspections at his cost during the warranty period. When equipment and labor covered by the Security Contractor's warranty or by a manufacturer's warranty have been replaced or restored because of his failure during the period of that warranty, the warranty period for the replaced or repaired equipment or restored Work shall be reinstated for a period of time equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event that any manufacturer customarily provides a warranty period greater than one (1) year, the Security Contractor's warranty shall be for the greater period of time.

E. Change to System: In no case shall the integrated system/security equipment warranties be voided where user-programmable programming changes are performed by the trained Owner's appointed system programming representative, to include redefining system input/output points, operation characteristics, time delays, and report formats to the Owner's site-particular requirements.

2.15 PROTECTION OF CONTRACT DOCUMENTS

A. All security system Contract Documents shall be considered Sensitive Security Information (SSI) and shall be handled as defined in 49 CFR, Parts 15 & 1520. The Security Contractor shall protect all documents and materials that identify the Owner's security systems and equipment. All such documents and materials shall be uniquely numbered for identification. They shall be kept in locked containers when not in use or during non-working hours. They shall not be transferred to subcontractors or others without assurances in writing that the same level of protection will be provided. Discarded documents (such as drawings) shall be destroyed by burning or by other means rendering the document unreadable and precluding the reconstitution of the document to a readable state.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. The Security Contractor shall install the security system in accordance with the standards for safety, UL-1037 and UL-1076, and the appropriate installation manual for each equipment type. Security Contractor does not have to be a UL-listed contractor. Components within the system shall be configured with appropriate "service points" so that system trouble can be pinpointed in less than twenty (20) minutes.

3.02 CABLE/WIRES INSTALLATION

A. Security Contractor-provided cable/wire runs and conduit shall be installed in accordance with applicable electrical Work standards, national and local codes, and NFPA 70, as well as manufacturers' specifications of installed equipment.

3.03 INTERIOR WIRING AND CONDUIT FOR SECURITY SYSTEMS

A. General: In addition to requirements specified in other sections of the Specification, as a minimum, the Security Contractor's Work for Division 28 shall conform as described herein. Conflicts, if any, shall be promptly brought to the attention of the Owner.

B. Codes: All Work shall be in accordance with the National Electrical Code (NEC) and local governing codes and laws.

C. Interior Conduit Type: All interior conduits shall be electro-metallic tubing (EMT), except where otherwise noted. Exceptions for different conduit types for various classes of construction shall be requested of the Owner as appropriate, such as for cast-in-place concrete, buried conduit, exposed conduit, and placement in cable ducts. Minimum size of conduit shall be three-quarter (3/4) inch, with the exception of "drop" conduits at door locations which may be one-half (1/2) inch. Connections shall be thread-less type fittings or couplings. Fastenings and supports for conduit shall be in accordance with the national and local codes. All security systems conductors shall be installed in conduit. Exceptions shall require the Owner's written approval.

D. Conduit Routing: Conduits shall have runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. All conduits shall be affixed or supported at intervals and using prescribed methods and devices in accordance with governing codes. No run of conduit between outlets or fittings shall contain more than four quarter bends (360 degrees). Bends shall be made such that the conduit will not be injured and that the interval diameter will not be effectively reduced. All connections shall be tight so as not to create intermittent loss of ground protection. All cut ends entering into fittings shall be reamed smooth or have a bushing inserted to prevent damage to wire insulation. Conduit and raceway runs shall be kept at least six (6) inches from non-insulated flues, steam pipes or any pipe containing a hot gas or liquid. So far as practical, avoid traps and dips in conduit runs that might collect moisture. Strict attention shall be given to all conduits containing fiber optic cabling, if any, to ensure that manufacturer's recommended conduit bend radii limitations/restrictions are followed.

E. Connectors: Where conduits connect to sheet steel enclosures, they shall be fastened with two (2) locknuts where insulating bushings are used. Bushings shall be installed on ends of all conduits where they terminate in pull boxes, outlet boxes, cabinets, etc. and shall be of the insulating type and shall be securely fastened with locknuts on each side. Crushed or deformed conduits shall not be installed. Bushings shall not be used as locknuts. Open ends shall be sealed around security conductors to be liquid tight using an approved air drying sealer after capping ends with insulated bushings.

F. Special Conditions: Conduits crossing expansion joints in concrete slabs shall be provided with suitable expansion fittings, or other suitable means, to compensate for building expansion and contraction. Conduits traversing hazardous areas shall use the penetrations and fittings shown on the drawings and provided under other sections of the contract. The Security Contractor shall seal the fittings subsequent to verifying the integrity of the contained conductors. Conduit shall not block ceiling or equipment access doors. Where conduit or raceway is passed through walls, floors, ceilings or roofs, annular space shall be sealed or patched. Openings in fire walls and all corridor walls shall be sealed with mineral wool or an approved silicone sealant. No conduit shall be fastened to other pipe or conduit or installed so as to prevent the ready removal of other pipe or conduit for repairs. Conduit, panels, devices and boxes shall be secured by means of shields in concrete, machine screws on metal surfaces and wood screws on wood construction material. Threaded studs driven in by power charge and provided with either lock-washers and nuts or nail type nylon anchors are not acceptable in lieu of machine screws. Wood plugs shall not be used as expansion shields. Unless conditions or Drawings dictate otherwise, panels shall be located between 3'-6" and 6'-0" above finished floor level.

G. Shop Drawings: Security Contractor shall submit conduit and wire layout drawings showing circuit numbers, types of conductors, size of conduits, and wiring/conduit routes for approval by the Owner prior to the initiation of Work. Security Contractor shall coordinate shop drawings of the security systems conduit routing with fire wall construction, mechanical duct work, structural components, fire protection, and plumbing.

H. Conductor Types: Conductors shall be copper, and shall not have a diameter less than eighteen (18) AWG, unless otherwise indicated. Exceptions will be made for vendor-provided leads, internal equipment wiring and low voltage power conductors. If required, the Security Contractor shall modify equipment wiring fittings that will not accept eighteen (18) AWG minimum conductors, however, UL listings must be maintained on any modified UL-listed equipment. Conductors for intercom systems and for multiplexed data communications shall be a minimum of twenty-two (22) AWG. Other exceptions for use of smaller gauge conductors must be approved by the Owner. Cables used as risers shall be plenum rated.

I. Movement: Conductors interconnected to equipment subject to movement shall be stranded or shall be of a type manufactured specifically for such interconnections.

J. Fire Rated Conductors: All conductors, which are required to meet fire-safety ratings and electrical and building code requirements, shall satisfy such requirements. As one example, in the event that Owner was to approve the installation of exposed conductors for certain locations, conductors installed in plenums shall be fire-rated for such applications, such as by means of rated Teflon-jacketed conductors.

K. Sizing: Wire fill, conductors, and conduit shall be sized by the Security Contractor in compliance with the NEC. The number of conductors required may vary on the basis of the manufacturers of the selected equipment. In no event, shall conduit fill exceed 40%.

L. Sharing Conduit: In the event that security conductors must share conduit with other low voltage conductors, prior approval of the Owner is required. All system conductors shall be run concealed wherever practical, and shall be placed in conduit.

M. Continuous Wiring: All conductors shall be run continuously between sensors, processors, junction boxes, terminal strips or panels, and other approved devices. Splices between such locations are not permitted. Necessary junctions shall be made using screw-type terminal blocks, or in accordance with manufacturer's requirements for equipment connections.

N. Line Supervision: Line supervision requirements shall be observed.

O. Color Codes and Tagging: All conductors shall be color coded and tagged consistently. Coordination with Owner of exact wire tagging is mandatory. All conductors shall be yellow in color on the outermost jacket. Transposing or changing color coding of conductors shall not be permitted. Covert conductor identification shall be provided within each enclosure where a tap, splice or termination is made, and at the equipment terminal of each conductor. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking will not be accepted. Marking shall be an approved permanent type utilizing an electronic labeling method. Tagging devices shall be approved and shall be permanent, not subject to inadvertent separation. All conductors at control consoles shall be bundled, neatly fanned out, and tagged. Cables and wires shall be tagged to clearly indicate their electrical characteristics, circuit number and panel designation. Tagging shall be such that several conductors may be disconnected and reconnected without the use of drawings.

P. Shielding: If required by manufacturers' specifications, shielding requirements shall be observed.

Q. Pulling: Only approved pulling compounds shall be used. Pull strengths shall not exceed standards established by the NEC.

3.04 ADJUSTMENT/ALIGNMENT/SYNCHRONIZATION/CLEANING

A. Subsequent to installation, the Security Contractor shall clean each system component of dust, dirt, grease or oil incurred or accrued from other project activities, and prepare for system activation by manufacturer's recommended procedures for adjustment, alignment, or synchronization. Each component shall be prepared in accordance with the appropriate provisions of the component's installation, operations, and maintenance manuals.

3.05 CLEAN, SQUARE INSTALLATION

A. All equipment shall be clean and free of paint and other defacing materials. All installations shall be square and plumb. The Security Contractor shall take care that other trades do not deface equipment and do not move equipment out of square and plumb. If equipment is moved, the Security Contractor shall re-install the equipment to be square and plumb.

3.06 TESTS AND VERIFICATIONS

A. General: The Security Contractor shall verify that all requirements of this specification are met. Upon completion of the installation, procedures shall be performed to calibrate and test all equipment, verify data transmission media (DTM) operation, place the integrated system in service, and test the integrated system. A report shall be submitted describing results of functional tests, diagnostics, and calibrations, including written certification that the installed complete system has been calibrated, and tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

B. Verification by Inspection: Verification by inspection includes examination of an item and the comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the cited paragraph. Inspection may require moving or partially disassembling the item to accomplish the verification. Inspection shall be made of all equipment installations, proper functioning of all locking hardware and lock controls, mounting and wiring of electrical and signal distribution cabinets and components, and mounting and placement of sensors, video cameras, etc. to ensure requirements of the specifications are complied with and that the overall installation is accomplished in a professional and workmanlike manner. The Owner shall have full opportunity to witness the required Security Contractor inspections or to conduct his own inspections of the installation.

C. Verification by Test and Demonstration: The Security Contractor shall verify by formal demonstrations or tests that the requirements of the Specifications have been met.

D. Formal Test Verification Requirements: Paragraphs 1-3 below list specific requirements that shall be verified by formal demonstration/test. The Owner and the Engineer shall be afforded a fourteen (14) day advance notice of all subsystem demonstrations/tests. The Owner reserves the right to witness any and/or all of the tests described below.

1. Preliminary Tests: Following installation, the Security Contractor shall individually test each sensor and other components and verify the proper functioning of each component within a particular subsystem. Each subsystem shall be similarly tested until all detection zones, alarm assessment components, alarm reporting and display, and access control functions have been verified. Prior to final functional and operational tests of the system, the Security Contractor shall correct any deficiency pertaining to these requirements. When subsystem verification is complete, the entire system shall be tested to assure that all elements are compatible and function properly as a complete system.
2. System Operation Test: Following completion of the preliminary tests and the security system and component formal demonstrations, the Security Contractor shall conduct a formal test, to be known as the "System Operation Test", in which all components and subsystems of the security system are demonstrated to operate together as a system. This test shall be performed over a continuous one hundred and twenty (120) hour period. A formal test plan and test procedures for each portion of the test shall be prepared by the Security Contractor and submitted for Owner approval in accordance with this Specification. Approval of the test procedures must be obtained prior to notification of testing to Owner. The Security Contractor shall demonstrate that the security system components and subsystems meet specification requirements in the "as-installed" operating environment during the "System Operation Test". While no formal environmental testing is required, the Security Contractor shall measure and record temperature, humidity, and other environmental parameters, and shall include this data in the test report to document the environmental parameters and the environment conditions which were encountered during the "System Operation Test".
3. Tests Upon Completion of Work: Upon completion of the Security Contractor's Work, the system shall be subjected to complete functional and operational tests. When all required corrections have been accomplished, the system shall be re-tested and the Owner notified in writing fourteen (14) days in advance of the proposed final acceptance testing and inspection date. The advance notice shall include certification that the installation is complete and operable and has satisfactorily performed the final tests specified herein. The acceptance testing and final inspection will be accomplished in the company of the Owner. Twenty-eight (28) days prior to the test date, the Security Contractor shall prepare and submit for approval of the Owner, a complete and detailed final acceptance test check-off list ("punch list"). The list shall be a complete representation of all specified functions and conditions, including contingency, priority, and abnormal modes of operation. The arrangement of the list shall be such as to provide an orderly method of tabulating checks of system features, response and operation. The tests shall be structured so that all sensors and controls are stimulated directly in their installed and finally adjusted positions and all audible and visual displays, signals, alarms and other responses are observed and printed. At the time of final acceptance testing all required tests shall be repeated and all defects will be corrected until the system is found to be acceptable to the Owner. The Security Contractor shall maintain a log of all test activities and results. Typed copies of this log shall be submitted to the Owner within fourteen (14) days of the testing. Final tests shall include all the newly and upgraded systems, but not limited to the following:

a. Test of central processing equipment, workstations, peripherals, and software operation, including automatic and manual operations/functions and report capabilities;
b. Test all graphic control and annunciation functions and displays;
c. Test electrical supervision of all input/output sensor and data communication bus circuits;
d. Test all data gathering and distributed logic controllers;
e. Test of all alarm initiating devices;
f. Test of video system components, cameras, recorders, switchers, and monitors;
g. Test UPS;
h. Test of battery and battery chargers;
i. Test of security management system components;
j. Test of access control system to include card access, locking and tie-in to fire alarm system and elevator system;
k. Complete operation tests under emergency power, including power failure alarms;
l. Test of fiber optics and/or copper signal transmission system;
m. Visual inspection of all wiring;
n. Verification that all required submittals have been provided and have been accepted;
o. Demonstrate software and programming/reprogramming functions of all microprocessor systems; and
p. Verification of systems response time.

E. Test Preparation: The Security Contractor shall carefully plan and coordinate the final acceptance tests so that all tests can be satisfactorily completed during one continuous testing period. The Security Contractor shall provide all necessary instruments, labor and materials required for tests, the equipment manufacturer's technical representative, and qualified technicians in sufficient numbers to perform the tests within the time limits imposed by this Specification.

F. Re-Test: In the event that the Owner and the Engineer are required to witness a re-test at a later date because the Security Contractor is either not adequately prepared to conduct the acceptance tests or because the systems being tested are failing such tests, which shall be solely determined by the Owner witnessing the tests, the costs of witnessing additional tests (based on time and expenses at the established rates of the Owner) shall be borne exclusively by the Security Contractor. In such an event, the Security Contractor shall directly compensate the Owner for witnessing the tests; compensation shall be provided in advance of such, and all, additional tests.

G. Final Acceptance: Although successful completion of the final acceptance test has been completed, the security system shall not be considered accepted until it is determined that the complete security system is continuously trouble-free and operational, in a manner satisfactory to the Owner, for at least a seven (7) day period following final acceptance testing. A print-out of the system's activity log will be accepted as proof of compliance with this requirement. In the event that the system fails this operational test, the Security Contractor shall make the necessary adjustments and the seven (7) day period will restart from the beginning. If the system fails to complete this operational test for four (4) consecutive seven (7) day restarted test periods, the system shall be considered inoperable and unacceptable. The Security Contractor shall make all necessary repairs, adjustments, and/or replacements, at no additional cost to the Owner. When all adjustments have been completed and after proper notice has been given, the complete acceptance test will be re-performed and witnessed from the beginning. The Security Contractor shall be liable for all expenses for witnessing the retest as specified above. Repeated unsatisfactory operation and chronic system failures shall be reasons considered by the Owner for complete removal and replacement of the system. In this event, the Security Contractor shall be liable for all expenses and damages incurred, including legal fees and court costs.

H. Reliability/Maintainability Data: The Security Contractor shall record hours of component, subsystem and system operation, together with failure and repair data. This information shall be incorporated into the System Test Report to be submitted to the Owner.

3.07 REMOVE UNFIT MATERIAL

A. Within twenty-four (24) hours after receiving notice from the Owner, the Security Contractor shall remove from the project site all materials condemned by the Owner as failing to conform to the Contract Documents (whether incorporated in the Work or not). Security Contractor shall promptly replace and re-execute his Work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all Work of other contractors destroyed or damaged by such removal or replacement.

3.08 CUTTING AND PATCHING

A. General: This paragraph specifies administrative and procedural requirements for cutting and patching. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

B. Definition: Except where specified elsewhere, all references to cutting and patching shall be construed to mean the requirements of this section. Failure by the Engineer to cross reference this section to any or all sections wherein cutting or patching operations might be encountered or required, shall not be construed to relieve the Security Contractor of his responsibility to perform the Work nor shall it be construed to entitle the Security Contractor to additional payment for cutting and patching operations performed on this Project. Security Contractor shall be responsible for all cutting, fitting and patching required to complete the Work including:

1. Work required to make several parts fit together properly;
2. Relocation of new or existing devices;
3. Removal and/or replacement of existing devices;
4. Removal and replacement of defective Work;

5. Removal and replacement of Work not conforming to the requirements of the Contract Documents;
6. Removal of samples of installed Work as specified for testing;
7. Routine penetrations of non-structural surfaces to permit installation of new construction elements;
8. Cutting and patching associated with new construction;
9. Cutting and patching associated with the installation of ill-timed Work; and,
10. Cutting and patching associated with corrective Work.

C. Supervision: Provide adequate supervision for all cutting operations and maintain structural integrity at all penetrations. Carefully perform all cutting to the existing surfaces encountered during the course of the Work of this project to the extent necessary and required to permit the installation of new Work and to remove existing Work in place. Where structural members require cutting, submit proposed cutting and shoring for approval prior to beginning the Work.

D. Penetrations: Close all abandoned penetrations, new and old, whether visible or concealed in and adjacent to work being performed as a part of the Work of this Contract when such penetrations are revealed by demolition procedures specified herein

E. Matching Materials: Use matching materials and finishes. Obtain Owner's prior approval before installing materials or finishes that substantially deviate from existing material, color or texture. Comply with the other specified requirements.

F. Rated Construction: Where cutting and patching occurs in rated construction, repair wall, ceiling or floor assembly as necessary to maintain the required rating.

G. Substitutions: Should conditions of the Work or schedules indicate a change of material or products from the original installation, the Security Contractor shall submit requests for substitutions as specified.

H. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that will result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

I. 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, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

J. Materials: Comply with the specifications and standards for each specific product involved. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

K. Inspection: Before cutting, examine the surfaces to be cut and patched and the conditions under which the authorized Work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the Work.

L. Temporary Support: To prevent failure, provide temporary support of work to be cut.

M. Protection: Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.

N. Performance: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. General: Execute cutting and related demolition by methods which will preclude damage to other work and which will provide proper surfaces and planes to receive the installation of subsequent repairs and finishes.
2. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction.
    a. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
    b. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
    c. Perform penetrations through concrete floors and masonry walls in a manner, and employing methods and equipment so as to preclude reverse side spalling.
    d. Perform all penetrations through concrete floors, roofs, and concrete masonry unit walls with core machines or other approved equipment.
    e. Punching of penetrations will not be permitted.
3. Excavating: Comply with requirements of Specification where cutting and patching requires excavating and backfilling.
4. Utilities: By-pass utility services before cutting, where such utility services are required to be removed, relocated or abandoned. After by-passing and cutting, cap, valve or plug and seal remaining portion of pipe and conduit to prevent entrance of moisture or other foreign matter.
5. Patching:
    a. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the Work.
    b. Fit the Work smoke tight to pipe, sleeves, ducts, conduit, and other penetrations through surfaces. Provide USG "Safing Insulation" to fill joints around penetrations; provide UL-listed sealants to fill joint around penetrations in fire-rated construction, in order to maintain the original fire ratings.
    c. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.
    d. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime base coat.

3.09 CONTRACT CLOSEOUT

A. Comply with the requirements of this section and all relative sections. Administrative and procedural requirements for project closeout include, but are not limited to, the following:

1. Inspection procedures (see TESTS AND VERIFICATIONS Section above);
2. Operational tests as may be required by jurisdictional authorities (specified below);
3. Project record document submittal (specified below);
4. Operation and maintenance manual submittal (specified above);
5. Submittal of warranties and bonds (specified below); and,
6. Final cleaning (specified below).

3.10 JURISDICTIONAL COMPLIANCE

A. Submit evidence of compliance with the requirements of governing authorities, including inspecting officials, the Certificate of Occupancy and, where applicable, copies of Certificates of Inspection.

3.11 RECORD DOCUMENTS SUBMITTALS

A. General: Do not use Record Documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to Record Documents for the Owner's reference during normal working hours. Submit Record Specifications and Record Drawings for the Owner's records upon completion of the Work.

B. Record Drawings: Maintain a clean undamaged set of blue or black line white-prints of Contract Drawings and shop drawings.

1. Mark the set to show the actual installation where the installed Work varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately. Where shop drawings are used for mark-up, record a cross-reference at the corresponding location on the working drawings. Give particular attention to concealed Work that would be difficult to measure and record at a later date.
2. Mark record sets with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work.
3. Mark-up new information, which is known to be important to the Owner, but was not shown on either Contract Drawings or shop drawings.
4. Note related change-order and addendum number where applicable.
5. Convert marked-up as-built drawings to computer-generated drawings. Hand-drawn sketches or markups will not be accepted.
6. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including Addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in the actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on Work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related Record Drawing information and product data, where applicable.

3.12 GUARANTEES, WARRANTIES, AND BONDS

A. General: Comply with the requirements of this and other Sections.

B. Inspections: The Contractor shall provide for four (4) periodic inspections at his cost during the warranty period. When equipment and labor covered by the Contractor's warranty or by a manufacturer's warranty have been replaced or restored because of failure during the period of that warranty, the warranty period for the replaced or repaired equipment or restored Work shall be reinstated for a period of time equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event that any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same period of time.

C. Bound Copies: Provide two original, signed, bound copies of assembled warranties, bonds, and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and Subcontractors.

D. Table of Contents: In a neatly typed and orderly sequenced format provide complete information for each item as follows:

1. Product or work item.
2. Firm, with the principal's name, address, and telephone number.
3. Scope.
4. Date of the beginning of warranty, bond, or service and maintenance contract shall be the date established by the Owner for Final Acceptance.
5. Duration of warranty, bond, or service and maintenance contract.
6. Proper procedure in case of failure.
7. Instances that might affect validity of the warranty or bond.
8. The Security Contractor, responsible principal's name, address, and telephone number.

3.13 FINAL CLEANING

A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. All stains, soil marks, dirt and other forms of defacement resulting from the Security Contractor's Work shall be removed or repaired. The Security Contractor shall remove from the Project site all tools, appliances, debris, and packing materials; remove all paint stains, blemishes, and foreign materials; clean all mechanical and electrical equipment. Use only materials and cleaning agents recommended by the material supplier. The Security Contractor shall assume responsibility for damage caused by his cleaning operations.

B. Inspection: Immediately prior to Final Completion and the final inspection visit, the Security Contractor shall thoroughly clean the project work area. The Security Contractor shall schedule and attend the Owner's inspection visit.

C. Approval: The Owner will be the judge of acceptability of the finished Work.

3.14 FINAL SUBMITTALS

A. The Security Contractor shall furnish to the Owner the following items prior to final payment (Contractor's final Application for Payment will not be processed by the Owner without receipt of closeout submittals):

1. Project Record Documents.
2. All Guarantees and Warranties.
3. All Maintenance and Operation Manuals.
4. Duly executed Affidavit of Payment of Debts and Claims.
5. Duly executed Affidavit of Release of Liens.
6. Consent of Surety to final payment, if bond required.

3.15 TRANSFER OF MATERIALS

A. Upon completion of the Project, the Contractor shall release any materials and/or obligations defined in this Specification to the Owner and as the Owner deems necessary. Materials and/or obligations shall include, but not be limited to the following:

1. As-built drawings.
2. Maintenance and service agreements.
3. Instruction and testing materials.
4. Guaranties, warranties and bonds.

END OF SECTION 280500

SECTION 280526 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

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. The requirements of Section 280500 – Common Work Results for Electronic Safety and Security apply to this section.

C. All Division 27 Specification Sections in this Specification Manual must be coordinated to and integrated with this Section. Refer to the Specifcation Manual Table of Contents for a Complete listing of Division 27 Specification Sections. [Remove where not applicable]

D. All Division 28 Specification Sections in this Specification Manual must be coordinated to and integrated with this Section. Refer to the Specifcation Manual Table of Contents for a Complete listing of Division 28 Specification Sections. [Remove where not applicable]

1.02 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.

1.03 DEFINITIONS

A. Signal Ground: The ground reference point designated by manufacturer of the system that is considered to have zero voltage.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. Harger Lightning and Grounding.

2. Panduit Corp.
3. Tyco Electronics Corp.
4. .

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

D. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.02 CONNECTORS

A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

B. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

D. Busbar Connectors: Cast silicon bronze, solderless [compression] [or] [exothermic]-type mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] or comparable product by one of the following:

1. Chatsworth Products, Inc.
2. Harger Lightning and Grounding.
3. Panduit Corp.
4. .

C. Grounding Busbars: Predrilled rectangular bars of hard-drawn solid copper, [1/4 by 2 inches (6.3 by 50 mm)] in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.

D. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with)stainless-steel or copper-plated hardware for attachment to the rack.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
2. Bond shields and drain conductors to ground at only one point in each circuit.

B. Signal Ground:

1. For each system, establish the signal ground and label that location as such.
2. Bond the signal ground to the alternating-current (ac) power system service by connecting to one of the following listed locations, using insulated[No. 6 AWG,] stranded, Type THHN wire:
   a. Grounding bar in an electrical power panelboard if located in the same room or space as the signal ground.
   b. Telecommunications grounding busbar.
   c. .

C. Comply with NECA 1.

3.02 APPLICATION

A. Conductors: Install solid conductor for [No. 8] AWG and smaller and stranded conductors for [No. 6] AWG and larger unless otherwise indicated.

B. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch (900-mm) intervals.

3.03 CONNECTIONS

A. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

B. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pretwist the conductor.
3. Apply an antioxidant compound to all bolted and compression connections.

C. Shielded Cable: Bond the shield of shielded cable to the signal ground. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

D. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 280526

SECTION 280544 - SLEEVES AND SLEEVE SEALS FOR ELECTRONIC SAFETY AND SECURITY PATHWAYS AND CABLING

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. Sleeves for pathway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.
2. Penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized-steel sheet.
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] or comparable product by one of the following:
   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.
   f. .
3. Sealing Elements: [EPDM] [Nitrile (Buna N)] rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: [Carbon steel] [Plastic] [Stainless steel].
5. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] [Stainless steel] of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] or comparable product by one of the following:
   a. Presealed Systems.
   b. .

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of [250] g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide [1/4-inch (6.4-mm)] annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed[or unless seismic criteria require different clearance]..
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors [2 inches (50 mm)] above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [steel] [cast-iron] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 280544

SECTION 281300 - ACCESS CONTROL SYSTEM

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Policy 8.1 – Physical Security

B. Division of Public Safety Access Control Program Procedures for adherence to Policy 8.1

1. Access Control Procedures
2. Video Surveillance Procedures
3. Intrusion Alarm Procedures
4. Emergency Intercom Stations

C. IT Policies 5.4.1 Security of IT Resources, 5.7 Network Registry, 5.8 Authentication to Information Technology Resources and 5.10 Information Security

D. Crime Prevention Through Environmental Design Guidelines (CPTED)

E. Mercury Hardware Manuals

F. NFPA 730: Guide for Premises Security

G. NFPA 731: Standard for the Installation of Electronic Premises Security Systems

H. Other Design and Construction Standards and Standard Details. The following standards are mandatory and must be used when evaluating a holistic approach to security design:

1. CU DIV 26 Standards – Electrical (Secondary Low voltage, fire alarm, etc.)
2. CU Standard 087100 – Door Hardware
3. CU Standard 270000 – Communications
4. CU Standard Detail 5.1.1 – Single Door Access Control
5. CU Standard Detail 5.1.2 – Entry with Vestibule Access Control
6. CU Standard Detail 5.1.3 – Single Door Access Control Wiring Diagram
7. CU Standard Detail 5.1.4 – Entry with Vestibule Access Control Wiring Diagram
8. Division 28 - IP-Based Surveillance System
9. Division 28 – Conductors and Cables for Electronic Safety and Security
10. Division 28 – Common Work Results for Electronic Safety and Security

1.02 ACRONYMS IN THIS STANDARD:

A. ACCACCESS CONTROL COORDINATOR

B. ACP ACCESS CONTROL PROGRAM

C. CAS CARD ACCESS SYSTEM

D. CCA COPPER CLAD ALUMINUM

E. CPW CAMPUS POLICE WORKSTATION

F. CW CLIENT WORKSTATIONS

G. DPS DIVISION OF PUBLIC SAFETY

H. DPSC DIVISION OF PUBLIC SAFETY COMMUNICATIONS DRI DUAL READER INTERFACE MODULE

I. EMF ELECTROMAGNETIC FIELD

J. HDS HEAD-END DATABASE SERVER

K. IDS INTRUSION DETECTION SYSTEM

L. NVSSO NETWORK VIDEO SURVEILLANCE SYSTEM

M. OPERATOR PIM PANEL INTERFACE MODULE

N. POE POWER OVER ETHERNET

O. RIM READER INTERFACE MODULE SCP SYSTEM CONTROL PROCESSORS

P. SRI SINGLE READER INTERFACE MODULE

Q. TCP/IP TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL

R. TTL TIME TO LIVE

S. VMS VIDEO MANAGEMENT SYSTEM

1.03 INTRODUCTION

A. The contractor will provide a new Video Surveillance System including color, solid-state cameras and lenses within unitized domes, mounts, camera housings, virtual matrix switcher, monitors, network video recorders (NVR), software, licenses, power supplies, equipment enclosures, raceway, cabling, and other attendant components and hardware described in this Section.

B. This standard applies to all installatins subject to University Policy 8.1.

C. For the purposes of this standard, electronic security systems or devices include:

1. Access control (wired and wireless).
2. Networked video surveillance.
3. Intrusion detection.

D. Per University Policy 8.1, security and access control systems shall be integrated with the University central systems unless an exemption has been granted through ACP.

E. Electronic security systems/devices are to be installed as an independent system and not to be connected by hardware, integrated by software, or otherwise interfaced with any other control systems (ex. Building Automation Control System) or life safety systems except where specifically required by code or approved by appropriate system owner and DPS Access Control.

1.04 QUALITY ASSURANCE

A. The integrated security and/or access system including all equipment, components, and accessories shall be UL listed for this purpose.

B. The Contractor providing the security and/or access system must be certified by the equipment manufacturer and software vendor to install the approved equipment and licensed/registered by the New York State Department of State.

C. The contractor installing video surveillance equipment must be an AXIS Certified Installer.

1.05 SYSTEM DESIGN

A. The following elements shall be part of Basis of Design Construction Documents:

1. List of applicable Codes and Standards used in the system design including applicable versions of Building Code, Fire Code, NFPA 70, NFPA 72, NFPA 730 and NFPA 731. Identify Building Occupancy Type.
2. All electronic access control, plans and details shall be in a distinct sub-section of the general electric documents and contain “Security Systems” in the drawing title block.
3. Type of security system (card access, video surveillance, and/or intrusion).
4. Sequence of operation on all electrified devices (especially when fire or intrusion alarm and access control systems are interconnected).
5. Wiring type shall be per manufacturer of the access control devices specifications.
6. Main equipment shall be installed in a locked enclosure located in a secured area approved by DPS Access Control and the Door and Hardware Center Electrical Foreperson. Installation location of an intrusion panel also require the FM Operations Fire/Alarms & Security Technician in the case of intrusion panel.
    a. New Construction and Major Renovations shall have Access Control Equipment installed in dedicated rooms no smaller than 6 Feet by 8 Feet on every other floor of the building and shall be capable of accommodating all hardware for assigned locksets and equipment for a 50% addition of hardware in the future, as well as for a technician to be able to enter, secure with card access, and work within the space on all equipment while standing on the floor. Room must contain at least one AC outlet for technician equipment.

1.06 SUBMITTALS

A. Drawings and Specifications shall include all requirements for Submittals and for As-Built information. Submittals shall contain the following information:

1. Product information for all installed components.
2. Door riser diagram with typical equipment and device connection and labeling (A detailed connection diagram is not required until project completion).
3. System/Building riser diagram with reader module and intelligent system controller connections detailed and labeled.
4. Wire and raceway(conduit/wireway) schedule.
5. Battery stand-by and system load calculations.
6. Special system requirements (interlocks with other systems, for example).
7. System labeling materials and methods.
8. Something to ensure the controller, etc. is on the secure side. Ability to see the location confirmation with regards to doors, height, fire strobes – like making sure this info is on the contractor coordination drawing requirements.
    a. To ensure compliance with the intent of this standard, all associated contract submittals shall be reviewed by Facilities Engineering, CIT, Door and Hardware Center forepersons, and DPS Access Control prior to releasing final approved submittals to the contractor.
        1) Any device that generates an alarm to the Cornell Police or the DPS Communications Center must be pre-approved by the Chief of Police and DPS Communications Center Director prior to releasing an approved submittal to the contractor.

PART 2: MATERIALS AND EQUIPMENT

2.01 SYSTEM DESCRIPTIONS

A. Card Access Systems

1. Wired: Card Access Systems (CAS), at the User End, are comprised of card reader, door position sensing, electric hinge or power transfer (wired systems), door strike, latch, reader interface module, interconnecting power and communication wiring, head-end System Control Processor. All systems, unless exempted from University policy, are centrally monitored transmitting data to and received by DPS Access Control.
2. Wireless: Schlage AD400 – is comprised of an AD400 lockset (licensed for current CAS software), PIM400-1501 RSI wireless access point, Mercury 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 the currently employed secure credential. Cornell IT policies must be adhered to when attaching devices to the University network.

B. Emergency Call Station

1. Emergency Phones will be designed and installed to meet ADA requirements for height and clearances and signage. ADA compliant signage is required per the CUPD
2. These phones are to be connected to the Campus telephone system and are programmed to ring directly to the University Police Department.
3. Emergency phones shall be provided according to the requirements of NYS Building Code specifically section 1009.8. Two Way Communications.

4. Final locations shall be reviewed by CUPD Crime Prevention Unit

2.02 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. Alarm initiation.
4. Trouble initiation.
5. Activation of alarm notification.
6. Activation of trouble notification.
7. Activation of fire safety functions.
8. Total supervision, monitoring of abnormal conditions in the system.
9. Activation of off-premise signals that are sent to the ACP systems via the Bosch Central Station Existing intrusion hardware installations or Ethernet (Access Control supported systems).

B. 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 SCP(s).
2. Transmission of the selected alarm or trouble signal to the ACP Central System
3. Indication of the alarm or trouble condition at the computer monitor display at the CW, and DPSC, shall include the alarm or trouble description, time/date, building controller, device, input/output, priority code.

C. Activation of any card access device shall cause, but not be limited to:

1. Transmission of the data signal to the Building SCP(s) and ACP Central System.
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.

D. Items C and D above define normal operations. In the event of a communication failure between an SCP and the ACP Central System, these signals will be stored and forwarded to the ACP Central System when the communication is restored.

2.03 POWER REQUIREMENTS

A. Provide 120VAC power to the system power supply locations. Where available, provide a dedicated emergency power circuit.

1. 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).

1. 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 the University's Door and Hardware Center Electrical Foreperson.

D. Power supply 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 in series with other locksets, and never directly to the power supply output.

2.04 BATTERY BACK-UP POWER SUPPLY

A. Battery Back-Up Power Supply – Access Control Systems

1. Batteries shall be of the sealed, lead-acid type.
2. Batteries shall be capable of providing operating power to operate the system for a minimum of 24 hours, and at the end of that period, shall be capable of operating all alarm sounding devices for 15 minutes, where required.
3. Batteries shall be mounted in the control panel or a separate enclosure of similar type to the main control panel.

2.05 CABLE AND RACEWAY SYSTEMS

A. Cables shall be routed in conduit or an enclosed wireway with screw-on cover. Hinged wireway is not acceptable. Plenum cable installed in open air is not acceptable. CAT6 cables for video surveillance may be run with IT cabling if inside conduit or an enclosed raceway.

B. Raceway systems shall concealed in finished spaces. Surface raceway systems are permitted where ceilings are inaccessible and existing walls cannot be fished.

C. Cabling shall be run in such a fashion 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.

D. Cornell University Facilities Engineering (FE) must approve any deviations in wire, raceway systems, or raceway hardware.

E. Raceways shall be run from the field device to the head-end termination point in a professional manner, utilizing conduit, beam clamps, 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 workman-like manner, with raceways mounted so as not to interfere with the servicing of other building infrastructure systems in the future.

F. Specifications for Ethernet cabling:

1. All cable should comply with CIT cabling standards, be full copper and a minimum rating of CAT6.
   a. CCA (Copper Clad Aluminum) cabling shall not be used.
2. All cabling should adhere to current NFPA and NEC requirements for power over Ethernet. (Code requirements vs standard)

G. 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.

H. Adequate conductors shall be provided to allow for all functions the equipment is capable of providing regardless of use at the time of installation.

I. 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.

J. Card reader conductors shall be a minimum of 18 AWG./6-conductor, shielded, between card reader and reader interface. Belden model #9942 or equivalent.

K. Egress device conductors shall be a minimum of 22 AWG./2-conductor between egress device and reader interface module. Belden model #8442 or equivalent.

L. 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.

M. 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.

N. Security and Card Access wiring shall be installed in a separate conduit system independent of other system circuits. This excludes Ethernet cable that can be run in existing data conduit.

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 SCP.

2.06 DOOR HARDWARE

A. Refer to 087100 Door Hardware for electronic locking hardware requirements.

2.07 SYSTEM CONTROL PROCESSORS (SCP)

A. General

2.08 REFERENCE STANDARDS

A. NFPA 72 - National Fire Alarm and Signaling Code; National Fire Protection Association; Approved Edition.

1. Use of existing or single System Control Processor (SCP) is preferred. Multiple SCPs are acceptable when specifically requested by the customer or approved in design by the DPS Access Control Project Management team.
2. 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. Door and Hardware Center Electrical Foreperson must approve panel locations.
   a. 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. System Control Processor 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 Weigand Format.
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 12 time intervals.
4. Alarm Masking, Individual shunt times, available 6-digit pin code.
5. Two dedicated inputs for tamper and power failure status.
6. RS2/AccessIT Licensed Mercury Hardware: LP1501 for Schlage AD400 and PIM485 only; LP1502, LP2500.

2.09 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 shall always be in place.
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

1. Refer to SCP 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. RS2/AccessIT Licensed Mercury Hardware: MR16IN

2.10 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

1. Refer to SCP 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. RS2/AccessIT Licensed Mercury Hardware: MR16OUT.

2.11 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.

D. RS2/AccessIT Licensed Mercury Hardware: MR50

2.12 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.

D. RS2/Access IT Licensed Mercury Hardware: MR52

2.13 CARD READERS

A. The card readers shall be installed on the unsecured side of the door. It can be mounted adjacent to the door, on the door, or pedestal mounted. The reader shall be mounted in accordance with current ADA Compliance guidelines.

B. For double door installations, the inactive door must be monitored with door position sensor.

C. All doors with electrified locking hardware must have the request to exit (REX) built into the hardware and a door position sensor.

D. If a door operator is in use, the reader must be mounted adjacent to operator push pad.

1. a. Operators shall be wired in accordance with the electrical drawings in Appendix A of this document.

E. All doors must have key override that is only distributed to Facility managers, The Card Access door hardware shops staff, and emergency responders who may need access during a system failure.

F. Hard wired integrated locksets are approved for both interior and exterior doors not requiring door operators.

G. Multi-technology readers must be used and at a minimum must support 125KHz proximity and 13.56 MHz (iClass, MIFARE, DESFire). Additionally, where available, low power Bluetooth support should also be specified.

H. In the case of Assa Abloy products, this is typically specified by calling out the BIPS credential.

2.14 INTRUSION DETECTION CONTACTS

A. Where possible Intrusion Detection signals should be received from the Card Access hardware.

B. On standard person doors without Card Access hardware, the contact shall be mounted in the top of the doorframe, 4-6" from the lock edge of the door.

C. The electronic configuration for IDS contacts is normally closed and supervised.

2.15 EGRESS MOTION DETECTORS

A. Use of motion detection for egress is not permitted without obtaining an exemption from DPS Access Control, Door and Hardware Center Locksmith Foreperson, and the Director of Risk Management.

B. If approval is given:

1. Egress motion detectors shall be ceiling mounted whenever possible. When the detector must be wall or frame mounted above the door, it will be angled down as far as possible, to provide the proper coverage.
2. The coverage pattern shall reach from the detector to the level of the floor, and shall not protrude more than 12" out from the surface of the door, nor more than 6" past the doorframe on either side. Masking of the detector is acceptable to meet the coverage pattern.

2.16 EMERGNCY CALL STATIONS

A. Viking E-1600-45

1. Yellow in Color
2. Surface Mount
3. Emergency Call Button

2.17 ACCEPTABLE MANUFACTURERS AND RESELLERS

A. The equipment, components, and accessories shall be as specified in the contract documents. Requests for authorization to substitute, vary or change the specified equipment, components or accessories of the approved manufacturer must be submitted, in accordance with Cornell University’s General Requirements.

B. Equipment must be purchased through an authorized reseller for

a. Access Control: RS2/AccessIT Access Control software to ensure that licensing needs are met
b. Viking Electronics

2.18 IDENTIFICATION

A. Provide lettered phonetic identification plates on the following equipment, components, and accessories as noted below:

1. Building System Control Processors (SCPs)
2. Control Modules
3. Interface Modules
4. Remote Power Supplies
5. Provide computer-generated adhesive labels on system devices (Brady, Dymo, P-Touch).
   a. Intrusion Alarm dialer connections to be labeled per CIT standard 270000.

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 Software Labeling and Identification

1. System notes shall include:
   a. Access Control Panel locations, installing technicians name, and 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. SCPs shall be labeled SCP–U, where U is a value from 1-9.
2. DRIs shall be labeled DRI–UVWX, where U indicates its respective SCP numeral; and V is the SCP'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 SCP numeral; and V is the SCP'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.
   a. Examples
   b. SCP-2 is the second Intelligent System Controller in the building.
   c. RIM-2305 is the fifth Dual Reader Interface served from the third buss of the second Intelligent System Controller in the building.
   d. Device #230503 is the device on the third output of the fifth panel served from the third buss of the second System Control Processor in the building.

PART 3: EXECUTION

3.01 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 University's Door and Hardware Center Electrical Foreperson prior to installation start.

3.02 SYSTEM PROGRAMMING – CARD ACCESS

A. Cornell's DPS Access Control Program (ACP) will perform the initial setup programming prior to the installation.

1. All IP based devices must be delivered to DPS Access Control Program for configuration no less than three weeks prior to scheduled installation. Door and Hardware Center Electrical Tech or a Software certified installer shall provide all required wiring and terminations on the board prior to ACP configuration.
   a. Certification in AccessIT! Essentials and ACRE Hardware Essentials can be obtained from https://training.acre-co.com/ and proof of certification for each installer must be provided to the DPS ACP Project management team prior to picking up any hardware for installation.
2. ACP will perform initial setup programming to include:
   1) SCP configuration and labeling.
   2) Device hardening.
   3) User/Password configuration
   4) Creation of the device instance in the access control software.
   b. Creation or modification of the Emergency Response access level using the following naming convention (EMERGENCY RESPONSE).
3. Door and Hardware Center Electrical Tech or a Software certified installer will install and configure:
   1) RIM (reader interface module) configuration and labeling.
   2) Initial test Time Zones and Access Levels.
   3) Initially name devices.
   4) Facility Name, Room number, Room purpose, compass direction of installation while inside secure room, Interior(INT) or Exterior(EXT).
   5) Devices with no reader associated will have "-No RDR" appended to the end of the name.
   6) Devices with ADA Operators will have "- ADA" appended to the end of the name.

B. The security system installer is responsible for initial alarm programming and commissioning for intrusion devices with approval and collaboration of CUPD Community Engagement and DPS Communications Center.

3.03 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 Door and Hardware Center prior to commissioning.

C. Installation's project and/or construction manager shall schedule a systems commissioning with the DPS 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 DPS Access Control Project 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 DPS Access Control Project Manager. Turnover of a portion or the entirety of the system to the ACC may be withheld due to commissioning failures until resolved.

E. Coordinate with the Cornell Police and the DPS Communications Center to enable monitoring of the critical alarms during commissioning. Alarms will only be responded to after CUPD and DPS Communications have been satisfied that the location(s) in question have passed their certification process

3.04 PROJECT CLOSE OUT

A. Record drawings shall include but are not limited to the following information prior to the closeout of the project:

1. Head end equipment location and interface panel locations.
2. Power supply locations.
3. Battery calculations (vendor provided via submittals).
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 281300

SECTION 282000 - VIDEO SURVEILLANCE SYSTEM

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Policy 8.1 – Physical Security

B. Division of Public Safety Access Control Program Procedures for adherence to Policy 8.1

1. Video Surveillance Procedures

C. IT Policies 5.4.1 Security of IT Resources, 5.7 Network Registry, 5.8 Authentication to Information Technology Resources and 5.10 Information Security

D. Crime Prevention Through Environmental Design Guidelines (CPTED)

E. Mercury Hardware Manuals

F. NFPA 730: Guide for Premises Security

G. NFPA 731: Standard for the Installation of Electronic Premises Security Systems

H. Other Design and Construction Standards and Standard Details. The following standards are mandatory and must be used when evaluating a holistic approach to security design:

1. CU DIV 26 Standards – Electrical (Secondary Low voltage, fire alarm, etc.)
2. CU Standard 330100 – Utility Interruptions and Connections
3. CU Standard 330526 – Utility Identification: Direct Buried nonconductive
4. CU Standard 337500 – Medium Voltage Distribution
5. CU Standard 337800 – Pole Mounted Exterior Lighting
6. CU Standard 087100 – Door Hardware
7. CU Standard 270000 – Communications
8. CU Standard Detail 5.1.1 – Single Door Access Control
9. CU Standard Detail 5.1.2 – Entry with Vestibule Access Control
10. CU Standard Detail 5.1.3 – Single Door Access Control Wiring Diagram
11. CU Standard Detail 5.1.4 – Entry with Vestibule Access Control Wiring Diagram

1.02 ACRONYMS IN THIS STANDARD:

A. ACCESS CONTROL COORDINATOR

B. ACP ACCESS CONTROL PROGRAM

C. CAS CARD ACCESS SYSTEM

D. CCA COPPER CLAD ALUMINUM

E. CPW CAMPUS POLICE WORKSTATION

F. CW CLIENT WORKSTATIONS

G. DPS DIVISION OF PUBLIC SAFETY

H. DPSC DIVISION OF PUBLIC SAFETY COMMUNICATIONS DUAL READER INTERFACE MODULE

I. EMF ELECTROMAGNETIC FIELD

J. HDS HEAD-END DATABASE SERVER

K. IDS INTRUSION DETECTION SYSTEM

L. NVSSO NETWORK VIDEO SURVEILLANCE SYSTEM

M. OPERATOR PIM PANEL INTERFACE MODULE

N. POE POWER OVER ETHERNET

O. RIM READER INTERFACE MODULE SCP SYSTEM CONTROL PROCESSORS

P. SRI SINGLE READER INTERFACE MODULE

Q. TCP/IP TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL

R. TTL TIME TO LIVE

S. VMS VIDEO MANAGEMENT SYSTEM

1.03 INTRODUCTION

A. The contractor will provide a new Video Surveillance System including color, solid-state cameras and lenses within unitized domes, mounts, camera housings monitors, network video recorders (NVR), software, licenses, power supplies, equipment enclosures, raceway, cabling, and other attendant components and hardware described in this Section.

B. This standard applies to all installatins subject to University Policy 8.1.

C. For the purposes of this standard, electronic security systems or devices include:

1. Access control (wired and wireless).
2. Networked video surveillance.
3. Intrusion detection.

D. Per University Policy 8.1, security and access control systems shall be integrated with the University central systems unless an exemption has been granted through ACP.

E. Electronic security systems/devices are to be installed as an independent system and not to be connected by hardware, integrated by software, or otherwise interfaced with any other control systems (ex. Building Automation Control System) or life safety systems except where specifically required by code or approved by appropriate system owner and DPS Access Control.

1.04 QUALITY ASSURANCE

A. The integrated security and/or access system including all equipment, components, and accessories shall be UL listed for this purpose.

B. The Contractor providing the video surveillance must be certified by the equipment manufacturer and software vendor to install the approved equipment and licensed/registered by the New York State Department of State.

C. The contractor installing video surveillance equipment must be an AXIS Certified Installer.

1.05 SYSTEM DESIGN

A. The following elements shall be part of Basis of Design Construction Documents:

1. List of applicable Codes and Standards used in the system design including applicable versions of Building Code, Fire Code, (NFPA 70),NFPA 72, NFPA 730 and NFPA 731. Identify Building Occupancy Type.
2. All video surveillance plan and details shall be in a distinct sub-section of the general electric documents and contain “Security Systems” in the drawing title block.
3. Type of security system (Video Surveillance).

1.06 SUBMITTALS

A. Drawings and Specifications shall include all requirements for Submittals and for As-Built information. Submittals shall contain the following information:

1. Product information for all installed components.
2. Wire and raceway(conduit/wireway) schedule.
3. Battery stand-by and system load calculations.
4. System labeling materials and methods.

PART 2: MATERIALS AND EQUIPMENT

2.01 SYSTEM DESCRIPTIONS

A. Video Surveillance Systems (NVSS)

1. Comprised of IP-enabled cameras, interconnecting power and communication wiring via POE (power over Ethernet). Cameras must be connected to a POE- enabled switch with ports enabled on the appropriate security VLAN except where approved by DPS Access Control. All systems, unless exempted from University policy, are capable of being centrally monitored and transmitting data to the central VMS. Some systems are also locally monitored within a specific unit.
2. Minimum Camera Requirements:
    a. Every Camera installation must first have an assessment completed by DPS Access Control during design to determine the appropriate device and installation location suitable for the requirements.
    b. 8 frames per second.
    c. Support for 64GB SD card.

B. Campus User Workstations

1. Client Workstations shall have access to the current Access Control Software through remote desktop protocols and the current VMS through a web browser while connected to the University network.

2.02 SYSTEM OPERATION AND PERFORMANCE

2.03 POWER REQUIREMENTS

A. Provide 120VAC power to the system power supply locations. Where available, provide a dedicated emergency power circuit.

1. This power supply shall be permanently labelled at all equipment it feeds.

B. Power supply must be per hardware manufacturer’s specification.

C. Varying voltage supplies should be kept separate from each other.

D. 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.

2.04 BATTERY BACK-UP POWER SUPPLY

A. Uninterrupted Power Supply – Video Surveillance Systems

1. Capable of providing 30 minutes for all connected devices, or enough time to transition from shore power to emergency power when present.

2.05 CABLE AND RACEWAY SYSTEMS

A. CAT6 cables for video surveillance may be run with IT cabling if inside conduit or an enclosed raceway.

B. Raceway systems shall concealed in finished spaces. Surface raceway systems are permitted where ceilings are inaccessible and existing walls cannot be fished.

C. Cabling shall be run in such a fashion 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.

D. Cornell University Facilities Engineering (FE) must approve any deviations in wire, raceway systems, or raceway hardware.

E. Raceways shall be run from the field device to the head-end termination point in a professional manner, utilizing conduit, beam clamps, 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 workman-like manner, with raceways mounted so as not to interfere with the servicing of other building infrastructure systems in the future.

F. Specifications for Ethernet cabling:

1. All cable should comply with CIT cabling standards, be full copper and a minimum rating of CAT6.
    a. CCA (Copper Clad Aluminum) cabling shall not be used.
2. All cabling should adhere to current NFPA and NEC requirements for power over Ethernet. (Code requirements vs standard)

G. Adequate conductors shall be provided to allow for all functions the equipment is capable of providing regardless of use at the time of installation.

2.06 REFERENCE STANDARDS

A. NFPA 72 - National Fire Alarm and Signaling Code; National Fire Protection Association; Approved Edition.

2.07 ACCEPTABLE MANUFACTURERS AND RESELLERS

A. The equipment, components, and accessories shall be as specified in the contract documents. Requests for authorization to substitute, vary or change the specified equipment, components or accessories of the approved manufacturer must be submitted, in accordance with Cornell University’s General Requirements.

B. Equipment must be purchased through an authorized reseller for

1. Video Surveillance: AXIS Camera reseller

2.08 IDENTIFICATION

A. Provide lettered phonetic identification plates on the following equipment, components, and accessories as noted below:

1. Provide computer-generated adhesive labels on system devices (Brady, Dymo, P-Touch).

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 Software Labeling and Identification

1. System notes shall include:
   a. Video Surveillance: AXIS Camera reseller
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. SCPs shall be labeled SCP–U, where U is a value from 1-9.
2. DRIs shall be labeled DRI–UVWX, where U indicates its respective SCP numeral; and V is the SCP'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 SCP numeral; and V is the SCP'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.
   a. Examples
   b. SCP-2 is the second Intelligent System Controller in the building.
   c. RIM-2305 is the fifth Dual Reader Interface served from the third buss of the second Intelligent System Controller in the building.
   d. Device #230503 is the device on the third output of the fifth panel served from the third buss of the second System Control Processor in the building.

PART 3: EXECUTION

3.01 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. Existing Equipment shall not be connected to, modified, or otherwise tied into without approval from University's Door and Hardware Center Electrical Foreperson prior to installation start.

3.02 SYSTEM PROGRAMMING – VIDEO SURVEILLANCE

A. Cornell's DPS Access Control Program (ACP) will perform the initial setup programming prior to the installation.

1. The project will provide ACP with the devices no less than three weeks prior to scheduled installation.
2. ACP will perform initial setup programming to include:

a. Camera configuration and labeling.
b. Device hardening.
c. User/Password configuration.
d. Creation of the device instance in the video management software.

3. Cornell's Door and Hardware Center Electrical Tech or a certified installer will:
   a. Mount the device.
   b. Assist ACP with camera positioning during commissioning.

B. The building/unit Network video surveillance system operator (NVSSO), for the building implementing the security measures, shall approve camera views post commissioning.

1. NVSSO and their designees will be trained for local management by DPS Access Control program. Access to the system will not be granted until training and completion of the authorization and activation forms has occurred.
2. Authorization forms must be in place prior to this training.

3.03 TESTING, COMMISSIONING AND ACCEPTANCE

A. A final test of the respective security 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. Installation's project and/or construction manager shall schedule a systems commissioning with the DPS 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.

C. Coordinate with the Cornell Police and the DPS Communications Center to enable monitoring of the critical alarms during commissioning. Alarms will only be responded to after CUPD and DPS Communications have been satisfied that the location(s) in question have passed their certification process

3.04 PROJECT CLOSE OUT

A. Record drawings shall include but are not limited to the following information prior to the closeout of the project:

1. Head end equipment location and interface panel locations.
2. Power supply locations.
3. Battery calculations (vendor provided via submittals).
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 282000

SECTION 284600 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 078700 - Smoke Containment Barriers: Smoke/fire curtains for interface with fire alarm system.

C. Section 087100 - Door Hardware:

D. Section 211300 - Fire-Suppression Sprinkler Systems: For interface with fire alarm system.

E. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: For non-power-limited cables.

F. Section 260526 - Grounding and Bonding for Electrical Systems.

G. Section 260533.16 - Boxes for Electrical Systems.

H. Section 271000 - Structured Cabling: Data cables for fire alarm system IP network connections.

1.03 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authorities having jurisdiction.

B. DMNS: Distributed mass notification system.

C. ECS: Emergency communications system.

D. EoL: End-of-line.

E. EVACS: Emergency voice/audio communication systems.

F. FACU: Fire alarm control unit.

G. HVAC: Heating, ventilation, and air conditioning.

H. IDC: Initiating device circuit.

I. LAN: Local area network.

J. MNS: Mass notification system.

K. NAC: Notification appliance circuit.

L. NPLFA: Non-power-limited fire alarm.

M. PLFA: Power-limited fire alarm.

N. SLC: Signaling line circuit.

O. SOO: Sequence of operation.

1.04 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 90 - Standard for Commissioning Building Electrical Systems; 2015.

F. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.

G. NFPA 3 - Standard for Commissioning of Fire Protection and Life Safety Systems; 2024.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

M. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

N. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

O. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

P. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

Q. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

R. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

S. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

T. UL 1638 - Standard for Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

U. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

V. UL 2075 - Standard for Gas and Vapor Detectors and Sensors; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.
2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.
3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
4. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
5. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
6. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
7. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative to review devices, notification appliances, and equipment locations.

2. Conduct meeting with facility representative and other related equipment manufacturers to discuss fire alarm system interface requirements.
3. Conduct meeting to review anticipated installation of code-required smoke control requirements, product solutions, and SOO.
4. Convene one week before starting work for review of documented SOO for system applications.

C. Sequencing:

1. Verify exact termination locations required for boxes, enclosures, and equipment.
2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).
5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Evidence of designer qualifications.

C. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.

D. Circuit Calculations

1. Provide NAC ampacity and voltage drop calculations.
2. EVACS Provide speaker db loss calcualtions for each speaker circuit.
3. Provide Standby battery calcualtions.

E. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.

1. The existing fire alarm system in the building is being upgraded to a JCI Simplex 4100ES fire alarm system with EVACS. All work on this system must be of same manufacturer and integrated with the entire VMS building system.
2. Copy (if any) of list of data required by AHJ.
3. NFPA 72 "Record of Completion", filled out to extent known at time.
4. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.
5. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.

6. Certification by manufacturer of FACU that system design complies with Contract Documents.
7. Certification by Contractor that system design complies with Contract Documents.

F. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.

1. System zone boundaries and interfaces to fire safety systems.
2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
3. Include elevations and details of proposed equipment arrangements.
4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
6. Include requirements and control diagrams for interfacing with other systems.
7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
8. List of devices and notification appliances on each SLC, with spare capacity indicated.
9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
11. Detailed drawing of graphic annunciators, displays, and interfaces.
12. Certification by either FACU manufacturer or manufacturer of related equipment.
13. Certification by FACU manufacturer that system design complies with Contract Documents.
14. Certification by Contractor that system design complies with Contract Documents.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Evidence of installer qualifications.

I. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test," filled out.

J. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:

1. Complete set of specified design documents, as approved by AHJ.

2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

K. Project Record Documents: See Section 01 7800 for additional requirements, have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, and updated input/output chart.

L. Closeout Documents:

1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III (three) or Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.

B. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.

1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least two years of experience installing fire alarm systems.
3. Supervisor: Level III (three) or Level IV (four) certified fire alarm technician; furnish name and address.

C. Manufacturer Qualifications: The system alterations in the Swing Space area renovation is to be compatible with the JCI Simplex 4100ES system.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

C. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

D. Existing Conditions:

1. Existing Fire Alarm System: Remove items from existing system and integrate new devices and wiring into existing system.. Comply with NFPA 70.
    a. Maintain existing under warranty as if new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected.
2. Modifications to Existing System:
    a. Remove inactive or abandoned cables and components from existing fire alarm system.
    b. Remove unused existing components and materials from site and dispose according to local and federal requirements.
    c. Remove accessible portion of abandoned cables unless tagged with identification product suitable to withstand based on installed environment.

1.09 WARRANTY

A. Fire Alarm Control Units and Accessory Equipment: Provide minimum 3-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

A. General Requirements:

1. Provide new fire alarm system components complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.

2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    a. 36 CFR 1191 and ADA Standards.
    b. Requirements of AHJ.
    c. Applicable local codes.
    d. Contract Documents.
    e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
3. Fire Alarm System Products:
    a. Listed, classified, and labeled as suitable for purpose intended.
    b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
4. Provide fire alarm circuits in accordance with NFPA 70.
    a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
    b. Power Sources:
        1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
        2) Primary: Dedicated branch circuits from facility power distribution system.
        3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
    c. Wiring and Wiring Methods:
        1) General Requirements:
            (a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.
            (b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.
            (c) Special Occupancies: Comply with NFPA 70.
            (d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.
        2) Fire Alarm Circuits:
            (a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.
            (b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
                (1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
            (c) Power-Limited Fire Alarm (PLFA) Circuits:
                (1) Provide identification for PLFA circuits in accordance with NFPA 70.
5. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
    a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.
    b. Pathway Class Designations:

1) Unless otherwise indicated or required, pathways to meet the following requirements:
   (a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
   (b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).
   (c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

B. Fire Alarm System Interfaces and Control Functions:

1. UL 864 listed unless otherwise indicated.
2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.
5. Other Interconnected Systems: For systems listed below, provide minimum of two monitoring point inputs each.
   a. Gas Detection Systems: Including providing notification appliances as indicated on plans for NOX - Nitrous Oxide, CO2 - Carbon Dioxide, CO - Carbon Monoxide, and HC - Hydrocarbon.
   b. Special hazard systems and associated interlocks.
6. HVAC Systems:
   a. Air Handling Units (AHUs) and Roof Top Units (RTUs):
      1) Provide duct smoke detector on supply side of air stream for units over 2,000 cfm.
      2) Provide duct smoke detector on return side of air stream for units over 15,000 cfm.
      3) Provide remote test station for each duct smoke detector unless explicitly indicated as not required.
      4) Provide output signal to shut down units with at least one duct smoke detector via addressable relay module.
      5) Where fire/smoke dampers are located downstream of unit, provide monitoring point input to determine that unit is not operational and subsequently provide output signal to close such dampers via addressable relay module and power isolation relay.
7. Fire/Smoke Dampers:
   a. Provide output signal to close fire/smoke damper via addressable relay module and power isolation relay.
   b. Fire/smoke damper activated as indicated on drawings.
      1) By room/area smoke detection (in lieu of duct smoke detection), where area/room is provided with smoke detection throughout and all dampers serving such room/area are activated.

2.02 FIRE ALARM CONTROL UNITS AND RELATED EQUIPMENT (EXISTING)

A. Manufacturers:

1. JCI Simplex.

B. Fire Alarm Control Units and Related Equipment: Listed and labeled as complying with UL 864.

C. Provide cabinets and enclosures as indicated or as required to house system components.

D. Fire Alarm Control Unit (FACU): Addressable.

1. SLCs and IDCs: Configurable for Class B or Class A with additional modules.
2. NACs: Integral and programmable with synchronization modules or cards as required.
3. Power Supply: 120 VAC, 60 Hz, supplying necessary power for FACU.
4. User-Interface: Touchscreen display for system interfacing and service mode settings, include password and user credentials; configurable for custom actions and incorporates historical event log.
5. Support self-testing detector capability.
6. Remote Annunciator Support: Up to 10.
7. Provide NAC expansion as required.

E. Notification Appliance Circuit Expansion:

1. Where notification appliance circuit requirements exceed capacity of FACU, provide accessories and cabinets as required for expansion.

2.03 FIRE ALARM SYSTEM INITIATING DEVICES

A. Manufacturers:

1. JCI Siemens.
2. Source Limitations: Furnish initiating devices produced by same manufacturer as FACUs where possible.

B. General Requirements:

1. Addressable Systems:
   a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.
   b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly permitted to be connected together as one zone, provide separate addressable monitoring point for each device in order to be individually identifiable by addressable FACU.
2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.

4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.

C. Manual Fire Alarm Boxes/Pull Stations:

1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
   a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.

D. Spot-Type Detectors:

1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
   a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
3. Smoke Detectors:
   a. Listed and labeled as complying with UL 268.
   b. Provide sensor type (e.g., photoelectric, ionization) as indicated.
   c. Provide automatic drift compensation.
4. Thermal/Heat Detectors:
   a. Listed and labeled as complying with UL 521.
   b. Provide sensor type (e.g., fixed temperature, rate-of-rise) and rating as indicated.
5. Carbon Monoxide Detectors:
   a. Listed and labeled as complying with UL 2075.
   b. Provide end-of-life notification.

E. Accessories:

1. Remote Test Stations: Allows for detector key switch test and reset; provides visual and audible indication of alarm condition.

2.04 FIRE ALARM SYSTEM NOTIFICATION APPLIANCES

A. Manufacturers:

1. Source Limitations: Furnish notification appliances produced by same manufacturer as FACUs where possible.

B. General Requirements:

1. Provide signaling notification appliances listed for fire-protective service and intended operating mode, public or private; suitable for connection to FACU notification appliance circuits.
2. Provide notification appliances and associated accessories suitable for intended application and location to be installed. Use notification appliances only according to listed mounting (e.g. ceiling, wall).
3. Surface-Mounted Notification Appliances: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
4. Notification Appliance Derating: Include device derating adjustments in accordance with listing where applicable, including the following.
    a. Where accessory protective guards or enclosures are utilized.
    b. Where required by field conditions (e.g., ambient temperature and sound).

C. Visible Notification Appliances:

1. Public Mode Operation: Listed and labeled as complying with UL 1971.
2. Private Mode Operation: Listed and labeled as complying with UL 1638.
3. Strobes: Clear or nominal white lens with flash rate of 1 Hz unless otherwise indicated or required; xenon or LED light source with maximum pulse duration of 0.02 seconds; candela rating as indicated.
    a. Where field-selectable candela strobes are specified, substitution of fixed candela strobes is not permitted.

D. Speakers for ECS:

1. Listed and labeled as complying with UL 1480.
2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet in accordance with UL 1480.
3. Frequency Range: 400 to 4,000 Hz minimum in accordance with UL 1480; listed for producing 520 Hz low frequency alarm signal for sleeping areas in accordance with NFPA 72.
4. Speaker Voltage: Field configurable, matched to audio distribution circuit voltage.
5. Provide minimum of four field-selectable power taps.

E. Combination Notification Appliances: Comply with respective requirements for each signaling method.

2.05 WIRE AND CABLE

A. General Requirements:

1. Comply with NFPA 70 listing and marking requirements for cables.

B. Power-Limited Fire Alarm Cables (PLFA):

1. Comply with applications of listed cables in accordance with Chapter 7 of NFPA 70.

C. Non-Power-Limited Fire Alarm Cables (NPLFA):

1. Comply with NPLFA circuit conductor properties in accordance with NFPA 72.
2. Comply with listing requirements in Chapter 7 of NFPA 70.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that system capacities listed in manufacturer instructions align with designed system.

B. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.

C. Verify ratings, configurations, and characteristics of system components.

D. Verify rough-ins for field connections.

E. Verify that work likely to damage fire alarm system has been completed.

F. Verify that interior of building has been protected from weather.

G. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.

H. Verify that system bonding is in accordance with Section 260526.

I. Do not energize system until deficiencies have been corrected.

J. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.02 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:

B. Field Locations:

1. Obtain Owner's approval of locations of devices and notification appliances before installation.
2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.

C. Raceways and Supports:

1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
3. Install firestopping to preserve fire resistance rating of partitions and other elements.

D. Wiring and Connections:

1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
5. Provide grounding and bonding in accordance with Section 260526.
6. Comply with manufacturer's minimum cable sizes or ratings.
7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
8. Provide network wiring in accordance with NFPA 70.
9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
10. See manufacturer's instructions for batteries.

E. Fire Alarm System Components:

1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
    a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections
2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.
3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

F. Branch Power:

1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.

G. System Identification:

1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 260553.
2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
3. Mark location of disconnecting means for NPFLA circuits.
4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:

1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:

1. Perform required tests of NFPA 72. Record measured values during operational checks.
2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.

C. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.

D. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

E. Inspect and test in accordance with manufacturer's instructions.

F. Inspect wiring and components for damage and defects.

G. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.

H. Perform additional requirements related to testing and inspection during system startup.

I. Test for interface with other systems.

J. Test shunt trips to verify operation.

K. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

3.04 SYSTEM STARTUP

A. Obtain Owner approval prior to performing system startup.

B. Manufacturer Services: Provide services of manufacturer's authorized representation to systems startup. Include manufacturer's detailed startup procedures with submittals.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. See Section 017419 - Construction Waste Management and Disposal for field-generated construction waste requirements.

C. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.

D. Clean and repair existing materials and equipment that remain or are indicated for reuse.

E. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.

F. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.

G. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.

H. Repair scratched or marred exposed surfaces to match original factory finish.

I. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.06 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for additional requirements.

B. Comply with NFPA 3 for commissioning of fire protection and life safety systems.

C. Comply with NECA 90 for commissioning building electrical systems.

D. Support Commissioning Agent in assembling test data and generating reports.

E. Participate in four hours of seasonal testing, as scheduled by Commissioning Agent, six months from Date of Substantial Completion.

3.07 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.

E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.

G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

3.08 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for additional submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

C. Closeout Demonstration: Demonstrate operation of all functions to Owner.

1. Be prepared to conduct any of required tests.
2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of FACU manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
5. Repeat demonstration until successful.

END OF SECTION 284600