BEEBE HALL
CU MAKER HUB
RENOVATIONS

Project Manual & Specifications

September 14, 2026

Owner

Cornell University
Ithaca, New York 14853

Architect

Ashley McGraw Architects, D.P.C.
125 East Jefferson Street, 15th Floor
Syracuse, New York 13202

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Bid Proposal Certification Form

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AV

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END OF DOCUMENT

INSTRUCTIONS TO BIDDERS

Project:	Beebe Hall CU Maker Hub Renovations
Owner:	Cornell University Ithaca, New York 14853
Architect:	Ashley McGraw Architects, D.P.C. 125 East Jefferson Street, 15th Floor Syracuse, New York 13202

1. BID DOCUMENTS

The Bid Documents provided electronically by the Owner will consist of the following:

(1) Instructions to Bidders.

(2) Bid Proposal Certification Form.

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

(4) Drawings and Specifications.

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

Bid Documents are available electronically in the Owner's electronic project management Bid Portal under the Bid Package Invitation – Invitation Documents Tab.

Dataflow, Inc. maintains the current set of Documents and all addenda and is the contracted supplier for printed plans and specifications for this project. Contact Dataflow at CUProjects@goDataflow.com.

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2. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

a. Each Bidder shall acquaint themselves with location conditions as they exist, as well as the character of the necessary work to be carried out under the proposed Contract. A Pre-Bid Zoom meeting will be scheduled and include: a review of project related information, an opportunity to ask and receive responses to Bidder questions, and make such inquiries as are necessary to fully understand the subject facilities, physical conditions and/or restrictions attendant to the work under the Contract.

b. 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.

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

d. By submitting a Bid, the Bidder covenants and affirms that the Bidder has carefully examined all of the Bid Documents including Drawings, Specifications, and the Addenda and Bulletins, if any, as well as posed any questions associated with the Site, and that Bidder is satisfied 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.

3. DISCREPANCIES

a. Should a Bidder find discrepancies in or omissions from the Drawings, Specifications and associated Bid Documents, or be in doubt as to their meaning, Bidder shall at once enter the item in the Q&A Board of the Owner’s electronic management Bid Portal and an Addenda with written instructions will be sent to all bidders. Neither the Owner nor the Architect will be responsible for oral instructions. Every request for such interpretation should be in writing and entered into the electronic project management Bid Portal Q&A Board. Inquiries received in advance of the deadline established at the Pre-Bid conference will be given consideration.

4. PRE-BID CONFERENCE

a. A pre-bid conference has been scheduled for 1:00PM,October 1, 2026, in Room 133 of Humphreys Service Building.

https://cornell.zoom.us/j/93794962752?pwd=CwAavYXiFTbEAFuTK7sLIqJwsBs9ZE.1&from=addon

A Pre-bid walkthrough will follow and will meet at the Beebe Hall main entrance vestibule, 110 Arboretum 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.

5. ASSUMPTION OF RISK

Contractors/Subcontractors 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 walkthrough or similar activity constitutes acceptance of risk assumption.

6. BID SUBMISSION

Bid Submissions must include the following:

a. Base Bid entered into the electronic project management Portal broken down per the Bid Scope Tab Schedule of Values (Step 1: Bid Form of the Response Form tab).

b. Additional Required Information:

1. Bid Proposal Certification Form
2. Bid Bond
3. Bond Surety Company
4. Bonding Rate for Change Orders
5. Proposed Project Team and Resumes
6. Proposed Project Schedule
7. Unit Pricing
8. Substitutions

c. Bid Proposal Certification Form: The Bid Proposal Certification Form shall be signed by the Principal(s) or Officer(s) legally authorized to bind the Bidder, and to execute such documents on behalf of their respective firms or organizations, and the Certificates included in the Bid Proposal Certification Form shall be completed accordingly. Bidder's legal name should be fully and accurately stated. Completed form shall be without interlineation, alterations, or erasures unless initialed and dated by the signer; Owner expressly reserves the right to accept or reject any or all bids, and to waive irregularities or informalities in its sole and reasonable discretion.

d. Bid Bond: Each Bidder will be required to furnish a Bid Bond electronically via the electronic project management Bid Portal in the amount of 10% of the Bid Amount. Such Bid Bond 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 13 below.

7. SALES AND USE TAX EXEMPTION

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

8. FEDERAL EXCISE TAX

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

9. 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.

10. 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.

11. 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 electronic project management Bid Portal Bid Scope form, the Bidder shall list all portions of the work he proposes to perform directly with his 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 is required as part of the Proposal.

d. In the Bid Scope Tab in the electronic project management Bid Portal, a list of 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.

12. UNIT PRICES

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

a. Certain Unit Prices may be requested. If requested, a form will be attached to these instructions and will need to be completed and uploaded to the electronic project management Bidding Portal Response Form – Step 3 – Additional Required Information Custom Fields. All Bidders are required to bid on all Unit Prices without exception.

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

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

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

e. The Owner reserves the right to accept or reject any or all of the unit prices listed below prior to the execution of the Contract.

13. 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, are to be entered into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields by listing each proposed substitution, together with the amount to be deducted from the Base Bid if the substitution is accepted on the form supplied with these instructions. However, the Bidder is cautioned to make his base proposal on the materials and items specified by name or other particular reference.

14. ALTERNATE PROPOSALS

a. Certain Alternate Proposals may be requested by the Owner and are included in the General Requirements. They will be listed in the Bid Scope Tab in the electronic project management Bid Portal. All Bidders are required to bid on all Alternates without exception.

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

15. METHOD OF SUBMISSION

a. Base Bid shall be prepared and electronically submitted via the electronic project management Bid Portal. All required fields and attachments in the electronic project management Bid Portal must be completed.

b. Bid Proposal Certification Form shall be prepared electronically submitted as an attachment via the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields.

c. Completed and responsive Bid Proposals shall be submitted through the electronic project management Bid Portal no later than **2:00PM** on **October 20, 2026**.

d. Bid Proposals shall not contain any recapitulation of the work to be done. No oral, written, electronic or telephonic proposals, or modifications will be considered.

16. BID OPENING

a. Completed and responsive Bid Proposals will be opened electronically via the electronic project management Bid Portal. Responsive Bid results will be posted to the Facilities Contracts website at: https://fcs.cornell.edu/awarded-projects.. 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.

17. 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 provided in accordance with the Contract.

b. Award of the Contract shall be made to the bidder submitting the lowest responsive and responsible base bid who, in the opinion of the Owner, is qualified to perform the work. The competence and responsibility of the Bidders' proposed principal subcontractors will be considered in making the Award.

c. The Owner reserves the right to reject any or all Proposals, and to waive any informalities in Bidding. Contract award shall be subject to approval of Cornell University's Contractors Qualification Statement.

d. Bidder expressly warrants and commits that its Proposal shall remain unchanged and in full force and effect at the Owner's option for a period of not less than ninety (90) calendar days following the bid opening date.

e. Bidders may submit, recall, modify, resubmit or withdraw their Bids through the electronic project management Bid Portal up until the Bid Due Date and Time.

f. The Owner reserves the right to accept any of the Alternate Proposals listed within sixty (60) calendar days following the award of a construction contract or such other time as may be agreed to by the Owner and Contractor.

18. SCHEDULE OF VALUES

a. 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.

19. PERFORMANCE AND LABOR AND MATERIALS PAYMENT BONDS

Prior to commencement of on-site construction activities, 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. Each of these Bonds are to be in a form with such sureties as the Owner may approve. The cost of such bonds shall be included in the Bidders Proposal.

20. START OF WORK

a. Work at the site shall be started within seven (7) calendar days from the date of issuance of written authorization to proceed and shall achieve substantial completion of the project no later than December 31, 2027.

1. NOTE: Prior to commencement of any on-site construction activities, the successful Bidder shall:

i. Furnish the Owner with fully executed and satisfactory Payment and Performance bonds. No on-site construction activities may commence until executed and satisfactory bonds are in place for the subject project.

b. The construction schedule and completion are critical. The Contractor shall provide adequate labor and equipment in the Bid to ensure that no slippage of the schedule will occur.

21. ADDENDA AND BULLETINS

a. Bidders must acknowledge in Step 3 of the Bid Response in the electronic project management Bid Portal each Addendum and/or Bulletin issued during the bidding period.

22. REQUIRED POST-AWARD SUBMISSIONS BY THE APPARENT LOW BIDDER

a. Within fourteen days after bid opening:

(1) Six-Month Workforce Projection

b. Upon Execution of Contract:

(1) Insurance Certificate
(2) Performance Bond
(3) Labor and Material Payment Bond
(4) Schedule of Work (bar chart)
(5) Federal Tax Identification Number

END OF SECTION

UNIT PRICES

This form shall be completed by the bidder and uploaded into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields. (Reference Section 01 22 00)

UNIT PRICE		UNIT	ADD	DEDUCT
UP-1	Fluid Applied Flooring System Installation (ERF-1)	Square Foot	$	$
UP-2	Fluid Applied Flooring System Integral Base Installation (ERF-1)	Linear Foot	$	$
UP-3	Acoustical Panel System Installation (APC-3)	Square Foot	$	$

BEEBE HALL CU MAKER HUB RENOVATIONS

Cornell University, Ithaca, New York

BID PROPOSAL CERTIFICATION FORM

Vendor Name:	
Type of Firm, State of Incorporation if Applicable	
Street Address, City, State, Zip	

Having carefully examined the Instructions to Bidders, the "Conditions of the Contract" (General, Division 1 - "General Requirements"), Supplemental Conditions, the Drawings, Specifications and associated Bid Documents dated September 14, 2026, as prepared by Ashley McGraw Architects, D.P.C., 125 East Jefferson Street, 15th Floor, Syracuse, New York 13202, 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.

1. Receipt of the Addenda to the Terms and Conditions, Drawings or Specifications has been acknowledged in the Owner's electronic project management Bid Portal.

2. Milestone Dates

    a. The undersigned agrees, if awarded the Contract, to commence work at the site within seven (7) calendar days after date of issuance of written notice to proceed and to achieve substantial completion of the project no later than December 31, 2027.

    b. The Contractor shall provide adequate labor and equipment in the Bid to ensure that no slippage of the schedule will occur. Contractor shall attach a Project Duration Schedule to this form that meets the duration established.

    c. Following are additional Milestone Dates:

    d. The undersigned agrees, if awarded the Contract, to furnish a "Construction Progress Schedule" consistent with the agreed upon Construction Duration 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. Such schedule shall be in conformance with General Requirements, Section 01 32 16, 1.3, A.

3. Proposed Principal Subcontractors

    a. The undersigned agrees, if awarded the Contract, to employ subcontractors from the list submitted in the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields subject to the following provisions:

        i. The Owner and Architect reserve the right to review the list of "Proposed Principal Subcontractors" prior to the award of the Contract, 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.

4. Contractor Team:

    a. The Owner reserves the right to reject the names of any Project Manager or Superintendent provide in the electronic project management Bid Portal submission to whom they have a reasonable objection.

5. Bonds

    a. Bid Bond. A Bid Bond in the amount of a minimum of 10% of Bid Amount is attached to the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields.

    b. Performance and Payment Bonds. Prior to commencement of any on-site construction activities, the undersigned expressly agrees if awarded the Contract, to deliver to Owner executed "Performance" and "Labor and Material Payment Bonds" in such forms as are acceptable to the Owner and in an amount equal to 100% of the Contract Sum.

    c. Such bonds will be furnished by the Surety entered into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields

    d. Bonding Rate for Change Orders has been entered into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields

6. Bid Scope - 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 to the total Contract Sum submitted in the electronic project management Bid Portal.

7. 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.

c. Any Substitutions are to be entered into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields by listing each proposed substitution, together with the amount to be deducted from the Base Bid if the substitution is accepted.

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

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.

8. Unit Price Schedule

a. The undersigned agrees, if awarded the Contract, to perform work "In addition to" or "deducted from" the scope of the Contract Documents as directed by the Owner and/or Architect, computed in accordance with the unit prices form uploaded in the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields, which prices include all overhead, profit and other expense items in connection therewith, subject to the terms of the Contract Documents.

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

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

d. The Owner reserves the right to accept or reject any or all of the unit prices entered into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields prior to the execution of the Contract.

9. Acceptance

a. The undersigned agrees that the amount submitted for the Base Bid and any Alternates and Unit Pricing along with the required attachments in the Response Form – Step 3 – Additional Required Information Custom Fields submitted in the electronic project management Bid Portal have been reviewed and are accurate.

b. It is understood and agreed that the Owner expressly reserves the right to accept or reject any or all bids, and to waive irregularities or informalities in its sole and reasonable discretion.

c. Upon acceptance of Bidder's Proposal, Bidder expressly agrees and affirms to hold its unchanged Bid Proposal for ninety (90) calendar days. The undersigned will execute an Agreement between Contractor and Owner, amended and/or supplemented, if required, in accordance with the Proposal as accepted. Nothing contained herein shall preclude Bidder and Owner from mutually agreeing upon a Contract based upon the unchanged Bid Proposal if the time elapsed from Award is in excess of ninety (90) calendar days.

d. The undersigned acknowledges the following Addendum(s) (if applicable):

Addendum No. __ dated _____.

e. 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.

f. The undersigned agrees to furnish Owner satisfactory and executed Performance and Payment Bonds prior to the commencement of any Work on-site.

g. The undersigned acknowledges as Contractor to be and remain exclusively in control of the Project site and Work, as well as the Project's Health & Safety Plan, measures, and/or protocols, for the duration of construction activities.

h. Alternates:

1. 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 associated with the Base Bid in accordance with the 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.

2. It is understood that the Owner reserves the right to accept or reject any of the Alternate Proposals provided in the electronic project management Bid Portal within sixty (60) calendar days following the award of a construction contract or such other time as may be agreed to by the Owner and Contractor.

The following documentation is required to be submitted electronically in the electronic project management Bidding Portal Response Form – Step 3 – Additional Required Information Custom Fields

- ☐ This Form with Proposed Milestone Schedule – signed and executed
- ☐ Bid Bond
- ☐ Proposed Project Team Resumes
- ☐ Unit Pricing

_____
(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 its 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 that have been quoted in this bid have not been knowingly disclosed, directly or indirectly, by the bidder and will not knowingly be disclosed by the bidder to any other bidder or any competitor prior to opening.

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 and executed for and on behalf of said Corporation by authority of its governing body.

_____

(Secretary-Clerk)

Dated: _____

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

FOR

BEEBE HALL
CU MAKER HUB RENOVATIONS

CORNELL UNIVERSITY
ITHACA, NEW YORK

GENERAL CONDITIONS

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	Form III	Workforce Report
E		Labor Rate Breakdown
F		Stored Materials Invoicing Documentation
G		Contractor Performance Evaluation

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 sounder technique or workmanship, or better quality or greater quantity of material shall govern, unless the Owner directs 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 Wage Rates available at https://apps.labor.ny.gov/wpp/publicViewPWChanges.do?method=showIt. 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 or alternatives 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(s) or redesign(s), and all new drawings and details required thereto 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 appropriate and adequate to account 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 Contractor 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 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 Project 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, sufficiently stable to secure the required payment and performance bonds, and is sufficiently experienced in and competent to perform the subject Work or retain qualified subcontractors to perform elements of the Work pursuant to the Project’s plans and specifications;

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, accounted for weather days, 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 Contractor's failure 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 Contractor will have access to view and download the Bid Documents in the Owner's electronic project management system.

B. 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 with the exception of the signed Contract Set, are to be returned to the Owner along with the As-Builts 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

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.

The current Prevailing Wage Rate schedule can be found at https://apps.labor.ny.gov/wpp/publicViewPWChanges.do?method=showIt. All updates, corrections and copies of the annual determination are available at the New York State Department of Labor website.

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 Documents, 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 Documents. 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 and approve 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 and shall constitute a full payment for both the Work covered or arising from the order and for any damage or expense incurred by the Contractor by any delays, including any and all impacts, known or unknown, or delays to other Work to be done under the Contract resulting from said change order. The Contractor expressly 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 and processed via the electronic project management system.

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 dates 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 times 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 substantial and full completion within the time specified. It is expressly understood and agreed, that the times 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 the 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 - 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, known or unknown, including time extensions, 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, public health statistics or information, and injury requiring medical attention, pursuant to government authority, 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 (e.g., 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 on the part of the Contractor.

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 fully comply with and 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 3 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 10.06 A.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)
  $ 2,000,000 Each Occurrence
  $ 4,000,000 Aggregate

- Automobile Liability Insurance as per Section 10.06.A3

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

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

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

  Not less than $10,000,000 per occurrence

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

  Not less than $5,000,000 aggregate

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

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

Section 10.07 - Liability Insurance of the Owner

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

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

A. The Owner 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. If the project is bonded, a Consent of Surety to the reduction must be attached as well.

Section 12.04 - Withholding Payments

A. The Owner may, on account of contemporaneous or 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 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 - Laws Governing the Contract

The Contract shall be governed by the laws of the State of New York, without reference to conflict of law principles. Any and all proceedings relating to the subject matter hereof shall be maintained in New York State Supreme Court, Tompkins County or the federal district court for the Northern District of New York, which courts shall have exclusive jurisdiction for such purposes.

Section 15.03 - Assignments

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

Section 15.04 - 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 15.05 - 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 15.06 - 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 15.07 - 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 (Jason Cragle) shall be recognized by the Contractor.

Section 15.08 - 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 counteroffer. 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

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.

Section 16.02 – Participation by Minority and Women Business Enterprises

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 and WBE programs. These requirements include equal employment opportunities for minority group members and women (“EEO”) and contracting opportunities for certified minority and women-owned business enterprises (“MWBEs”). 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:

With respect to the procurement of goods and services and university contracting, Cornell University shall comply with all applicable state and federal laws, and refrain from discriminating against or considering the following in hiring or contracting: race, sex, sexual orientation, color, national origin, religion, or disability. Cornell's obligations surrounding state programs (MWBE utilization) and federal law regarding non-discrimination obligations continue to be the rule of law.

Section 16.03 – 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 Utilization Reports when requested by the Owner.

1. MWBE Utilization Report
2. Workforce Report

B. The Contractor shall provide a single monthly report, or as requested by the Owner, inclusive of all subcontractor information for the project labor and such report must document the use of MWBE businesses in the Contract.

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 on Non-Work Related Content

The Contractor shall not use or permit on the job site, in its external, advertising, marketing program, social media, or other promotional efforts, any date, pictures, or other content unrelated to the Contracted Work, or any 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://policy.cornell.edu/policy-library/standards-ethical-conduct. 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 entered into the electronic project management Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields 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.

In 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 Utilization Report

PART I – PROJECT INFORMATION

ePM Project No.	Project Name:	Contract Value:
Contractor Name and Address:	Primary Contact Name, Phone Number, Email:	Bid Date:
Contractor's MWBE Contact Name, Phone Number, Email:		

PART II – MWBE LIST (*Update as MWBE firms come under contract, sign and date, resubmit)*

Subcontractor Name, Address, Contact, Email, MBE or WBE *(List your firm if also MBE or WBE)*	Federal ID Number	Dollar Value of Contract or Purchase Order	Description of Work or Supplies	Subcontractor or Supplier Start and End Dates

(Update totals as MWBE firms are added/subtracted to above list)

Print Name of Principal or Officer:	Title:
Signature:	Date:

MWBE Utilization Report

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, or N/A	% of Total Contract
TOTALS		0		0

SUMMARY OF BID ACTIVITY WITH MBE AND WBE 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 and WBE Subcontractor/Vendor (Indicate which)	Item/ Trade	Bid Submitted: Date	Bid Submitted: Amount	Award Status 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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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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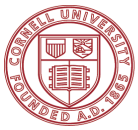
EXHIBIT "G"



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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GENERAL REQUIREMENTS

FOR

BEEBE HALL CU MAKER HUB RENOVATIONS

CORNELL UNIVERSITY
ITHACA, NEW YORK

SEPTEMBER 14, 2026

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SECTION 01 11 00 SUMMARY OF WORK

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1.1 DESCRIPTION

A. Work to be Done

The Contractor will provide renovations at Beebe Hall for the CU Maker Hub. Work includes but is not limited to the following:

1. New entry addition, exterior porch, and elevator.

2. New flooring, ceilings, painting, casework, and doors.

3. New HVAC, plumbing, electrical, fire suppression, fire alarm, security and access control, communications, and exterior site improvements.

4. Project to receive LEED Silver accreditation.

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.

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 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.

B. 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 (Jason Cragle) 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.

C. 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.

D. 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.

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

1.12 WORKING HOURS

A. Normal work hours are 7AM-3:30PM Monday-Friday 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 22 00 UNIT PRICING

1.0 GENERAL

1.1 RELATED DOCUMENTS

A. This Section describes Unit Pricing requested by the Owner.

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: Unit price is an amount proposed by bidders, stated on the Bid Proposal Submission Form and in the ePM Bid Module, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

B. Procedures. Unit Prices are for work complete, measured in place and cover profit and all other costs and expenses of the Subcontractor. 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 of the Subcontractor.

C. To the extent that a Subcontractor's Unit Prices are applicable, as determined by the Architect and Cornell University, 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 subcontract work which is either reduced or increased by more than 25%. Said Unit Prices shall be valid for the duration of the Subcontractor's activity on the project as applicable, unless stipulated elsewhere in the Contract Documents.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1 - Fluid Applied Flooring System Installation (ERF-1)

Provide fluid applied flooring system (ERF-1) per Specification Section 09 67 00 Fluid-Applied Flooring. Unit price to be per square foot for floor area and linear foot for integral base. Unit price is applicable to areas noted to receive CONC-1 in room finish schedule. Unit price to be based on a total quantity calculated by assuming that a minimum of 50 percent of the CONC-1 area will require the flooring system.

B. Unit Price 2 - Fluid Applied Flooring System Integral Base Installation (ERF-1)

Provide fluid applied flooring system integral base installation (ERF-1) per Specification Section 09 67 00 Fluid-Applied Flooring. Unit price to be per linear foot at 4 inches high. Unit price is applicable to areas noted to receive CONC-1 in room finish schedule. Unit price to be based on a total quantity calculated by assuming that a minimum of 50 percent of the CONC-1 area will require the flooring system

C. Unit Price 3 - Acoustical Panel System Installation (APC-3)

Provide acoustical panel system installation (APC-3) per Specification Section 09 51 00 Acoustical Ceilings. Unit price to be per square foot. Unit price to include all accessories for a complete system. Unit price is applicable to second floor areas with existing TECTUM ceiling integral deck system and is to be mounted directly over existing TECTUM system. Unit price to be based on a total quantity of 1,000 square feet.

*****END OF SECTION 01 22 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 pricing to add new sidewalk along west side of Arboretum Road and up to Beebe Hall parking lot, as noted on Drawings C200, C300, L101, L201, L301, and L401.

B. ALTERNATE NO. 2

Provide pricing to add new sidewalk along East side of Arboretum Road, as noted on Drawings C200, C300, L101, L201, L301, and L401.

C. ALTERNATE NO. 3

Provide pricing to add additional zones and controllability to the lighting, as noted on Drawings E200 and E201.

D. ALTERNATE NO. 4

Provide pricing to add fluid applied flooring system installation (ERF-1) with integral base in locations, as noted on Drawing A621, A701, and A702.

E. ALTERNATE NO. 5

Provide pricing to add acoustical panel system installation (APC-3) on the second floor, as noted on Drawing A122.

*****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
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 LEED MEETINGS

A. Owner will schedule an initial LEED coordination conference within twenty-one (21) days after date of Notice to Proceed, and Owner will schedule periodic LEED meetings on the site at not less than intervals required for LEED compliance.

1. Attendance:

    a. Architect

    b. Architect's professional consultants when, in the opinion of the Owner, needed

    c. General Contractor, including Site Superintendent

    d. Owner's Representatives, including Owner’s LEED Project Coordinator, and Owner’s Commissioning Agent.

    e. Subcontractors as appropriate to the agenda

    f. Suppliers as appropriate to the agenda

2. Minimum Agenda:

    a. Review, approval of minutes of previous LEED meetings

    b. LEED Project Checklist

    c. General requirements for LEED-related procurement and documentation

    d. Project closeout requirements and LEED certification procedures

e. Roles of Contractor's LEED Coordinator and Owner's LEED Project Coordinator

f. Construction waste management

g. Construction operations and LEED requirements and restrictions

h. Other business of significance that affects Owner's sustainable design goals and that could affect meeting requirements for LEED certification

B. All decisions, instructions, and interpretations given by the Owner's LEED Project Coordinator or its representative at these meetings shall be binding and conclusive on the Contractor.

1.5 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.

1.6 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 activitie(s) 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. LEED Submittals
3. Product Data
4. Samples and Mock-ups
5. Quality Assurance and Quality Control Submittals
6. Coordination Drawings
7. Certification of Asbestos free products
8. Post-Construction or Post-Renovation Asbestos survey, reference Section 01 35 29.
9. Owner audio/visual
10. 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 other each submittal appropriately for transmittal and handling.

1.10 RECORD SUBMITTALS

A. Provide a record copy of the submittal to the Commissioning Agent in electronic format. Record copy shall be a clean copy (free of notes from the design professional) which has been updated to reflect the "as-installed" system. Provide document in PDF format.

B. Record copy of the submittal must be forwarded to the Commissioning Agent within fourteen (14) calendar days of the final approved submittal.

C. Provide a record copy of the submittal (electronic format) for the O&M Manual.

1.11 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes noted on previous submittals.

B. Shop Drawings and Product Data:

1. Revise initial drawings or data, and resubmit as specified for the initial submittal.

2. Indicate any changes which have been made other than those noted by the Architect.

C. Samples: Submit new samples as required for initial submittal.

1.12 ARCHITECT'S DUTIES

A. Review submittals with reasonable promptness as identified in 1.9, paragraph 5 of this Section.

B. Notations on the Submittal Review Stamp or ePM file mean the following:

1. "Approved (APP)" indicates that no deviations from the design concept have been found and Work may proceed.

2. "Approved as Noted (AAN)" indicates that deviations from the design concept which have been found are noted, and the Contractor may proceed accordingly.

3. "Revise and Resubmit (RAR)" indicates that Work covered by submittal, including purchasing, fabrication, delivery, or other activity may not proceed. Revise or prepare new submittal according to Architect's notations; resubmit without delay. Repeat if necessary to obtain different action mark.

4. "Rejected (REJ)" indicates that Work covered by submittal, including purchasing, fabrication, delivery, or other activity may not proceed. Revise or prepare new submittal according to Architect's notations; resubmit without delay. Repeat if necessary to obtain different action mark.

5. "On Hold (ONH)" is used in a very limited capacity and means that the Contractor should not take action until the reason for hold has been cleared and may be required to revise and resubmit.

6. "Not Reviewed (NRV)" is used for submittals that were submitted in error, duplicate, or other reason that does not require review by the Architect but need to be closed by the Contractor upon return to them.

7. "For Record Only (FRO)": Submittals for information or record purposes, including Quality Assurance and Quality Control Submittals, and Material Safety Data Sheets (MSDS), will not require responsive action by the Architect.

a. Architect will forward informational submittals without action.

b. Architect will reject and return informational submittals not in compliance with Contract Documents.

C. Incomplete Submittals: Architect will return incomplete submittals without action.

D. Unsolicited Submittals: Architect will return unsolicited submittals to sender without action.

E. Return submittals to Contractor for distribution, or for resubmission.

1.13 DISTRIBUTION

A. Distribute reviewed Shop Drawings and copies of Product Data when possible via the ePM system to:

1. Job site file
2. Record Documents file
3. Subcontractors
4. Installers
5. Suppliers
6. Manufacturers
7. Fabricators
8. Architect
9. Owner

B. Do not permit use of unmarked copies or rejected copies of submittals in connection with construction at Project Site or elsewhere where Work is in progress.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 33 00*****

SECTION 01 35 29 GENERAL HEALTH & SAFETY

1.0 GENERAL

1.1 DESCRIPTION

A. This Section provides requirements for general health and safety during the project. The requirements of this Section shall apply to both Contractor and all tiers of Subcontractors involved in the project.

1. General Emergency Information – It is recommended that both Contractor and all sub-tiers:

a. Sign up for Cornell Emergency Alerts. The instructions can be found at (use the visitors section): https://emergency.cornell.edu/alert/

b. Signup for Tompkins County Emergency alerts at: https://www2.tompkinscountyny.gov/doer/swift911alerts

c. Cornell EHS has brief guidance on some emergency scenarios at: https://emergency.cornell.edu/eag/

B. In addition to the requirements of this Section, all laws and regulations by applicable local, state, and federal agencies shall apply to the Work of this contract. In some cases, the requirements of these Specifications may by intention exceed such legal requirements, but in no case shall this Specification be interpreted or understood to reduce or eliminate such requirements.

1.2 CONTRACTOR'S PROJECT SITE SPECIFIC PLAN

A. Contractors are required to submit a Project Site Specific Plan (PSSP) for review by Cornell University representatives before commencement of work on the site. The PSSP should address site specific information, controls and or requirements as it relates to the entire scope of work for the Project. All contractors shall use the Project Site Specific Plan Template below to develop their Project's PSSP. The template may be downloaded at:

https://ehs.cornell.edu/campus-health-safety/occupational-safety/contractor-safety

1. Within the PSSP template are example(s) to use as reference. The provided examples demonstrate Cornell University's expectations for providing detailed site-specific information, controls and requirements.

2. Project Site Specific Plan's that inadequately address site specific operations will be returned with comments for resubmission. Failure to submit a PSSP may result in delay of project and/or denial of the payment.

3. All projects must have the PSSP submitted via ePM for review and comment.

B. PSSP submittal should be submitted a minimum of ten (10) days prior to the commencement of work on site. The Contractor may opt to submit their PSSP in phases. The Contractor must submit a phase submission plan using the PSSP Submission table included in the PSSP template for approval by Owner's Representative with initial submission. Submit remaining phases no later than ten (10) days prior to the start of a new, predetermined project phase or milestone.

1. Projects having less than a ten (10) day turn-around shall coordinate their submittal with the Owner's Representative, who should coordinate with Occupational Health, Safety and Injury Prevention (OHSIP), the University Fire Marshall's Office (UFMO), applicable Authority Having Jurisdiction (AHJ) and Contract College's Codes Enforcement Official, if applicable.

C. The Contractor is responsible for its employees and its Subcontractors. Subcontractors are required to submit their PSSP to the General Contractor. The General Contractor is responsible to ensure all Subcontractor(s) PSSP's are adequate per their scope of work.

D. The General Contractor is required to ensure their project's PSSP is accurately maintained throughout the duration of the contract. Resubmission is required for any new scope elements not previously addressed by the Contractor's original PSSP.

E. Definitions:

1. Project Site Specific Plan (PSSP): A structured document that details the scope of the Contract Work and related site-specific controls, requirements and information for University and Contractor personnel. This document is not intended to be all inclusive of all applicable local, state and federal laws and regulations for which the General Contractor and its Subcontractor(s) are expected to comply.

2. Authority Having Jurisdiction (AHJ):

- The organization, office or individual responsible for approving equipment, an installation or a procedure (NYS Fire Code).

- The local government, county government or state agency responsible for the administration and enforcement of an applicable regulation or law (NYS Building Code-§202.2).

3. Occupational Health, Safety and Injury Prevention (OHSIP): A division of Cornell University's Environment, Health and Safety Department. The OHSIP division can be contacted at (607)-255-8200 or by email at askEHS@cornell.edu

4. SME: The University's subject matter expert.

1.3 AERIAL WORK PLATFORMS

A. The preferred method for Aerial Work Platforms (AWPs) boom storage is fully retracted and fully lowered to the ground.

B. In some circumstances booms may need to be stored in the air because of vandalism concerns, minimal size of storage location, etc.

1. If this is case, the area under the elevated boom must be blocked or arranged such that prevents people from walking, standing, working or parking vehicles underneath.

2. When booms are stored in the air consult the extended weather forecast. Booms should not be stored in the air during predicted high winds, or severe storms. AWPs become unstable at winds or gusts greater than 25 mph and must be fully lowered to prevent a tip-over.

1.4 ASBESTOS

A. All building materials and products provided for use in construction at Cornell University are to be free of asbestos. Materials must be surveyed by a certified environmental consultant and analyzed by an accredited laboratory either prior to installation or post installation. The results of the survey are to be reported to Cornell University Facilities Management Asbestos Coordinator. The Contractor must attach applicable Safety Data Sheets / Material Safety Data Sheets for each product documenting a 100% asbestos free status. The University may provide random testing of products for asbestos content. Any Contractor installed building materials or products found to contain asbestos shall be classified as defective work. Defective work shall be corrected by the Contractor as specified in the General Conditions.

B. Attached for the Contractor's information are asbestos reports which represent samples taken within the building.

C. Based on the above, disposal of asbestos containing material is not anticipated.

1.5 LEAD

A. Building may contain lead-based paint. The Contractor shall protect workers in accordance with OSHA regulations. The Contractor selects the means and/or methods to address the presence of lead-based paint, and must concurrently protect its workers based on the Contractor's means and/or methods. The Contractor is required to submit a lead plan that is site specific, indicating that the protective measures the Contractor proposes meet the OSHA standard 1926.62 "Lead in Construction Standards". This site-specific plan should address the particular methods the Contractor intends to protect its workers, the building occupants and the building structure based on its selection of addressing the presence of lead-based paint. The site-specific plan should be attached or written into the Lead Work Plan section of the Contractor's Project Site Specific Plan.

1.6 SITE VISITS

A. The undertaking of periodic Site Visits by Architects, Engineers or the Owner shall not be construed as supervision of actual construction, or make them responsible for the safety of any persons; or make them responsible for means, methods, techniques, sequences or procedures of construction selected by the Contractor or its Subcontractors; or make them responsible for safety programs and precautions incident to the Work, or for the safe access, visit, use, work, travel or occupancy of any person.

1.7 CONFINED SPACE

A. The Contractor shall be responsible for the identification of confined space in accordance with OSHA requirements. It is the Contractor's responsibility to engage the Project Manager who will collaborate with Environment, Health and Safety regarding questions or concerns on the confined space.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 35 29*****

PRE-RENOVATION SURVEY

FOR

ASBESTOS-CONTAINING MATERIALS AND LEAD-BASED PAINT

FOR THE

BEEBE HALL MAKER HUB PROJECT

AT

BEEBE HALL
FACILITY CODE 1033

CORNELL UNIVERSITY
ITHACA, NEW YORK 14850

DECEMBER 2025

PREPARED FOR:

Ashley McGraw Architects
125 East Jefferson Street
Syracuse, New York 13202

FOR SUBMISSION TO:

Cornell University
Facilities and Campus Services
Humphreys Service Building
639 Dryden Road
Ithaca, New York 14850

PREPARED BY:

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1.0 – EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

Watts Architects & Engineers (Watts) was retained by Ashley McGraw Architects to perform a pre-renovation survey for asbestos-containing materials (ACM) and lead-based paint (LBP) for the Beebe Hall (facility code 1033) Maker Hub project located on the Cornell University campus in Ithaca, New York.

According to Cornell Facilities records, Beebe Hall contains approximately 14,744 square feet of space and was built in 1910. Beebe Hall is currently used as faculty surge space. The scope of the project is to transform the existing building into the future home of the Cornell Maker Hub. It is anticipated that all interior spaces in the building will be impacted by the project. There is a concurrent roofing replacement project (being prepared by Bell and Spina) which intends to remove all existing EPDM roofing assemblies down to existing decks.

The field survey work was conducted by Watts on November 13, 2025 and included the following:

- Review of existing asbestos reports and laboratory data;
- A visual site inspection to identify suspect ACMs that are anticipated to be disturbed by the scope of the project;
- Collection and laboratory analysis of bulk material samples for asbestos that may be disturbed by the project;
- Testing of components that may be disturbed by the project for the presence of LBP using an X-Ray Fluorescence (XRF) analyzer;
- Documentation of asbestos bulk sample locations on drawings and chain-of-custody forms, and
- Inspection photographs.

Prior applicable asbestos survey reports reviewed for this investigation consist of the following:

- Beebe Hall (Building 1033) Suspect Asbestos Materials Overview Report prepared by Delta Engineers, dated May 15, 2014.

- Hazardous Materials Survey Report for asbestos and lead-based paint at Cornell University for the Cornell University – Phase I Beebe Hall and T-Barn project prepared by Ambient Environmental, Inc., dated November 7, 2024.

- Targeted Asbestos Testing Letter Report at Beebe Hall (Facility Code 1033) for the HVAC Controls and Related Equipment Upgrades project prepared by Watts, dated July 12, 2019.

- Limited Asbestos Survey Report for the Full Building Wall and Ceiling Systems project, performed at Beebe Hall (Building Code 1033), prepared by Delta Engineers (the report is not dated, but the field work was performed on April 24, 2014).

ASBESTOS-CONTAINING MATERIALS

The inspection included the collection of fifty-eight (58) bulk samples to represent identified suspect materials that may be disturbed within the proposed project limits. ACM is defined as any material containing more than one percent (1%) of asbestos. Based on laboratory analysis of bulk samples collected as part of this investigation, prior sampling, and visual observations, **no ACM were identified within the project limits.**

The following material was identified to be asbestos-containing, but is not anticipated to be disturbed by the project:

- **Tar on concrete roof deck[1].** The tar was identified as part of previous testing and was previously observed on roof 2 near the wall to roof 3. The roofing system is not anticipated to be impacted by the project. Tar is a non-friable material and is assumed to be in good condition.

[1] This material was sampled and determined to be asbestos-containing as part of previous testing. Applicable laboratory analytical data are included in Section 7.0 of this report.

NON-ASBESTOS-CONTAINING MATERIALS

Based on laboratory analysis of samples collected as part of this inspection, previous testing data and visual observations, the following materials have been identified to be non-ACM:

- Drywall (gray)
- Drywall joint compound (white)
- Ceramic wall tile grout
- Ceramic wall tile mastic (light tan)
- Ceramic floor tile grout
- Ceramic floor tile set bed
- Foil jacket on fiberglass insulated domestic plumbing
- Foil jacket on fiberglass insulated roof drain
- Foil jacket on fiberglass insulated mechanical system piping
- Exterior soffit/overhang
- Brick mortar
- Duct sealant (gray)
- Flange gasket (red, brittle)
- Tar coated copper through-wall flashing
- 4” vinyl cove base
- Cove base mastic (yellow)
- Light brown with speck 12” x 12” floor tile
- Light blue with speck 12” x 12” floor tile
- Floor tile mastic (light brown)
- Carpet square mastic (green)
- Firestop caulk (dark red)
- Window glazing compound (black, sticky)
- Interior caulk (black) at door frames

- Exterior caulk (light beige) at windows and doors
- Expansion joint caulk (light tan)
- Exterior caulk (black) at windows and doors
- Exterior caulk (light gray) below courtyard windows
- Exterior caulk (gray) below courtyard windows
- 2' x 4' light textured drop in ceiling tile[2]
- 2' x 4' tectum ceiling tile[2]
- Carpet mastic (yellow) [2]
- Parge coating on brick walls in the mechanical room[2]
- White end sealant coating on fiberglass pipe insulation[2]
- Foil jacket on HVAC ductwork[2]
- Gray flange sealant on HVAC ducts[2]
- Black EPDM roof membrane[2]
- Black isoboard facing[2]
- Brown craft paper[2]
- Gypsum joint fill[2]
- Black seamseal caulk[2]
- Brown flashing caulk[2]
- Light gray flashing caulk[2]
- Tan flashing caulk[2]
- Rubber flashing[2]
- Exterior brick[2]
- Exterior brick mortar[2]

[2] This material was sampled and determined to be non-ACM as part of previous testing. Applicable laboratory analytical data are included in Section 7.0 of this report.

LEAD-BASED PAINT

XRF Testing Findings

Representative XRF readings were taken on select building components throughout the proposed renovation areas. The list below represents the building components that were tested as part of this investigation. For additional information, refer to the XRF analyzer data table in Section 3.1.

- Drywall walls and columns
- CMU block walls
- Brick walls
- Fin tube radiator covers
- Doors and door frames
- Black metal door thresholds
- Concrete columns
- Ceramic wall and floor tile
- Porcelain sinks, urinals and toilets
- Red metal pumps in the mechanical room
- Interior stair components
- Exterior railings and fences
- Structural steel
- Ductwork
- Sprinkler piping
- Window components
- Louvers
- Parking lines

The following surfaces and/or materials were determined to be coated with and/or contain lead (greater than or equal to 1.0 mg/cm^2) and are therefore considered lead-based paint (LBP):

- Structural steel
- Exterior brown metal railings/handrails
- Rust colored metal window and door lintels

For additional information on each material that was tested, refer to the XRF analyzer lead data table in Section 3.1 of this report.

SUSPECT PCB-CONTAINING CAULK

At the time of the preparation of this report, none of the caulk materials or abutting surfaces at Beebe Hall had been analyzed for polychlorinated biphenyls (PCBs). Based on the approximate 1910 completion date, all identified caulks may contain PCBs. The current Cornell University Health and Safety protocol is to assume that the caulks contain PCBs, and to remove, handle and dispose of the caulks as PCB Bulk Product Waste.

The following caulks were observed within project limits:

- Firestop caulk (dark red)
- Interior caulk (black) identified at door frames
- Exterior caulk (light beige)
- Expansion joint caulk (light tan)
- Exterior caulk (black)
- Exterior caulk (light gray)
- Exterior caulk (gray)

OBSERVATIONS

During the survey, Watts' personnel investigated suspect ACM and LBP that may be disturbed by the Beebe Hall Maker Hub project at Cornell University in Ithaca, New York.

Prior asbestos bulk sampling survey reports performed at Beebe Hall have identified asbestos-containing tar on the concrete roof deck. The tar is not anticipated to be disturbed by the Beebe Hall Maker Hub project; there is a concurrent roofing replacement project (being prepared by Bell and Spina) which intends to remove all existing EPDM roofing assemblies down to existing decks. No asbestos-containing materials were identified as part of Watts' current investigation. No caulk was observed at CMU joints. No spray-on-fireproofing was observed. Fire doors were observed to be insulated with non-suspect foam. Wire insulation associated with fluorescent light fixtures and hanging light fixtures was observed to be non-suspect thermoplastic. Mirrors in restrooms were observed to be mechanically fastened to the walls. The acoustical wall padding in Room 101A was observed to be mechanically fastened to the walls. Window systems were observed to have a non-suspect rubber around the glazing.

Watts was not able to gain access to the following spaces during the November 13, 2025 investigation: Elevator machine room, elevator hoistway, Telephone Room and Room 101B. The existing elevator is hydraulic and was installed in 2003. While it is not anticipated that any ACM

will be discovered in these areas, they should be inspected, and suspect ACM should be sampled accordingly. There is also the possibility that a waterproofing on structural block exists. If there is a possibility that the structural block will be impacted by the project, the structural block will need to be inspected for suspect ACM with the assistance of a mason.

Included in this report are the following: drawings indicating approximate bulk sample locations collected by Watts' personnel, chain-of-custody forms, laboratory results, laboratory accreditations, and consultants license and certifications.

2.0 – ASBESTOS-CONTAINING MATERIALS

2.0 ASBESTOS-CONTAINING MATERIALS

Sampling and Laboratory Methodology

A NYSDOL-certified asbestos inspector from Watts collected bulk samples of all suspect ACM that may be disturbed by the proposed renovation project. Bulk samples were collected using simple hand tools from each matrix identified as a potential ACM.

Samples were delivered with the proper chain-of-custody forms to a New York State-accredited laboratory that is a participant in the Environmental Laboratory Approval Program (ELAP) and National Voluntary Laboratory Approval Program (NVLAP). All materials, except non-friable organically bound (NOB) materials, and cellulose-containing ceiling tiles (CCT) were analyzed by Polarized Light Microscopy (PLM) using NY ELAP Method 198.1. In addition, all samples analyzed via 198.1 were examined for the presence of vermiculite. CCTs and NOBs, which include, but are not limited to, roofing materials, mastics, and caulks underwent gravimetric reduction and were analyzed by Polarized Light Microscopy (PLM) using NY ELAP Method 198.6. Any CCTs or NOB materials that were found to be negative under PLM were then analyzed by Transmission Electron Microscopy (TEM) using NY ELAP Method 198.4. The New York State Department of Health (NYSDOH) protocol requires analysis by TEM if the PLM analysis does not confirm the presence of asbestos.

Where possible, Watts visually inspected identified ACMs to assess their condition. The condition of ACMs are classified as good, fair, or poor. The requirement for each designation is as follows:

Good: Material with no visible damage or deterioration or showing very limited damage or deterioration.

Fair: The surface of the material is crumbling, blistering, water-stained, gouged, punctured, or otherwise damaged with the damage covering less than one tenth of the surface if the damage is evenly distributed or up to 25% of the material if the damage is localized.

Poor: The surface of the material is crumbling, blistering, water-stained, gouged, punctured, or otherwise damaged with the damage covering more than one tenth of the surface if the damage is evenly distributed or more than 25% of the material if the damage is localized. Material with large areas hanging from the substrate, delaminated, heavily gouged, crushed, etc.

The following sections include information on all suspect ACM sampled and contain the following: a Homogeneous Materials List containing all suspect homogeneous materials identified, bulk sample location descriptions, corresponding bulk sample numbers, and whether or not they are ACM, drawings identifying the approximate locations of asbestos bulk samples, and asbestos laboratory reports and associated chain-of custody forms.

HOMOGENEOUS MATERIALS LIST
BEEBE HALL MAKER HUB PROJECT
BEEBE HALL – FACILITY CODE 1033
CORNELL UNIVERSITY, ITHACA, NEW YORK

Material Description	Sample Location	Type	Sample Number	Results (% Asbestos)		ACM
				PLM	TEM	Y/N
Drywall (Gray)	Room 101	M	240918-01	NAD	NA	N
	Room 205		240918-02	NAD	NA	
Drywall Joint Compound (White)	Room 101 – Column	M	240918-03	NAD	NA	N
	Room 205 – Wall		240918-04	NAD	NA	
	Room 10040 – Ceiling		240918-05	NAD	NA	
Ceramic Wall Tile Grout	Room 10020	M	240918-06	NAD	NA	N
	Room 20021		240918-07	NAD	NA	
Ceramic Floor Tile Grout	Room 10020	M	240918-08	NAD	NA	N
	Room 20021		240918-09	NAD	NA	
Ceramic Floor Tile Set Bed	Room 10020	M	240918-10	NAD	NA	N
			240918-11	NAD	NA	
Foil Jacket on Fiberglass Insulated Domestic Plumbing	Room 101 – Above Acoustical Ceiling Tile	M	240918-12	NAD	NAD	N
			240918-13	NAD	NAD	
Foil Jacket on Fiberglass Insulated Roof Drain	Room 201 - Roof Drain	M	240918-14	NAD	NAD	N
	Room 201 – Roof Drain Bowl		240918-15	NAD	NAD	
Foil Jacket on Fiberglass Insulated Mechanical Systems	Room 10060 – Chilled Water	M	240918-16	NAD	NAD	N
	Room 10060 – Steam		240918-17	NAD	NAD	
	Room 10060 – Glycol		240918-18	NAD	NAD	
Exterior Soffit/Overhang	Exterior Soffit/Overhang Outside Room 10040	M	240918-19	NAD	NA	N
			240918-20	NAD	NA	

HOMOGENEOUS MATERIALS LIST
BEEBE HALL MAKER HUB PROJECT
BEEBE HALL – FACILITY CODE 1033
CORNELL UNIVERSITY, ITHACA, NEW YORK

Material Description	Sample Location	Type	Sample Number	Results (% Asbestos)		ACM
				PLM	TEM	Y/N
Brick Mortar	Room 201 Room 10041	M	240918-21 240918-22	NAD NAD	NA NA	N
Duct Sealant (Gray)	Room 101	M	240918-23 240918-24	NAD NAD	NAD NAD	N
Flange Gasket (Red, Brittle)	Room 10060 – Domestic Cold	M	240918-25 240918-26	NAD NAD	NAD NAD	N
Tar Coated Copper Through-Wall Flashing	East Elevation North Elevation	M	240918-27 240918-28	NAD NAD	NAD NAD	N
4” Vinyl Cove Base	Room 101 Room 201	M	240918-29 240918-30	NAD NAD	NAD NAD	N
Cove Base Mastic (Yellow)	Room 101	M	240918-31 240918-32	NAD NAD	NAD NAD	N
Light Brown with Speck 12” x 12” Floor Tile	Room 10041 Room 10040	M	240918-33 240918-34	NAD NAD	NAD NAD	N
Light Blue with Speck 12” x 12” Floor Tile	Room 10041 Room 10040	M	240918-35 240918-36	NAD NAD	NAD NAD	N
Floor Tile Mastic (Light Brown)	Room 10041 Room 20063	M	240918-37 240918-38	NAD NAD	NAD NAD	N
Ceramic Wall Tile Mastic (Light Tan)	Room 20021	M	240918-39 240918-40	NAD NAD	NAD NAD	N

HOMOGENEOUS MATERIALS LIST
BEEBE HALL MAKER HUB PROJECT
BEEBE HALL – FACILITY CODE 1033
CORNELL UNIVERSITY, ITHACA, NEW YORK

Material Description	Sample Location	Type	Sample Number	Results (% Asbestos)		ACM
				PLM	TEM	Y/N
Carpet Square Masic (Green)	Room 101A	M	240918-41	NAD	NAD	N
			240918-42	NAD	NAD	
Firestop Caulk (Dark Red)	Room 10060	M	240918-43	NAD	NAD	N
	Room 10041		240918-44	NAD	NAD	
Window Glazing Compound (Black, Sticky)	Room 204 – Sidelight	M	240918-45	NAD	NAD	N
	Room 20001 – Door		240918-46	NAD	NAD	
Interior Caulk (Black)	Room 10041 – Door Frame	M	240918-47	NAD	NAD	N
			240918-48	NAD	NAD	
Exterior Caulk (Light Beige)	East Elevation – Window Sill	M	240918-49	NAD	NAD	N
	North Elevation – Window Sill		240918-50	NAD	NAD	
Expansion Joint Caulk (Light Tan)	East Elevation	M	240918-51	NAD	NAD	N
	West Elevation		240918-52	NAD	NAD	
Exterior Caulk (Black)	West Elevation – Door Frame	M	240918-53	NAD	NAD	N
	North Elevation – Window Frame		240918-54	NAD	NAD	
Exterior Caulk (Light Gray)	2nd Floor Courtyard – Wall/Floor Seam	M	240918-55	NAD	NAD	N
			240918-56	NAD	NAD	
Exterior Caulk (Gray)	2nd Floor Courtyard – Wall/Floor Seam	M	240918-57	NAD	NAD	N
			240918-58	NAD	NAD	

Results Abbreviations

NAD = No asbestos detected
NA = Not analyzed

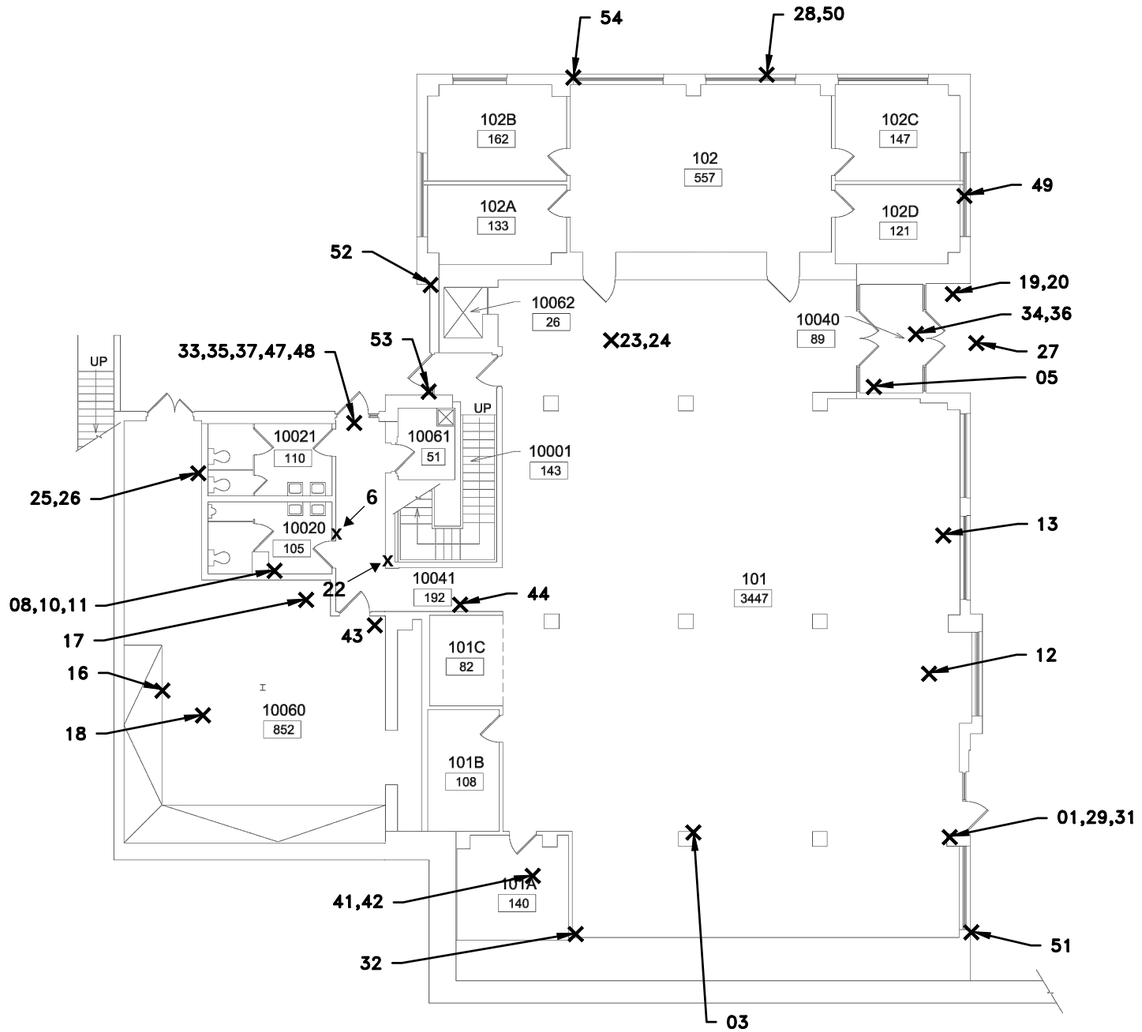
Type

M = Miscellaneous

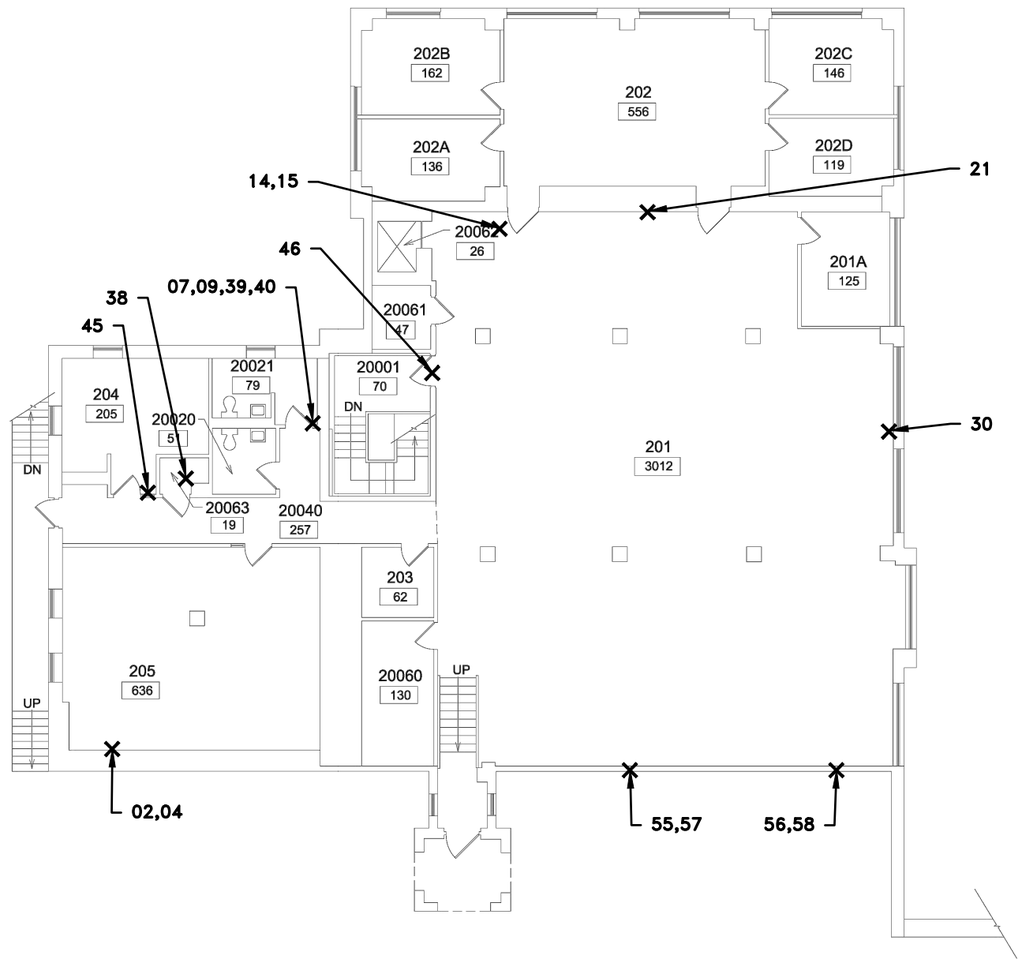
ACM

Y = Yes
N = No

2.1 – ASBESTOS SAMPLE LOCATION DRAWING



FIRST FLOOR PLAN



SECOND FLOOR PLAN

ALL SAMPLES ARE PREFIXED BY **240918–**

SAMPLES WERE COLLECTED ON NOVEMBER 13, 2025.

✕ INDICATES APPROXIMATE SAMPLE LOCATION

✕ SAMPLE NUMBERS IN RED WERE IDENTIFIED TO BE ACM.

ASBESTOS BULK SAMPLE LOCATIONS
BEEBE HALL
FIRST AND SECOND FLOOR PLAN

Watts Architects &Engineers
95 Perry Street, Suite 300
Buffalo, NY 14203

CORNELL UNIVERSITY
110 ARBORETUM ROAD
ITHACA, NY

NOT TO SCALE | NOVEMBER 2025

R:\2024\20240918 CU Beebe Hall Maker\18. CADD\Env\20240918_SL.dwg Nov 19, 2025, 12:17pm

2.2 – ASBESTOS LABORATORY REPORT AND CHAIN-OF CUSTODY FORMS

AmeriSci Richmond
13635 GENITO ROAD
MIDLOTHIAN, VIRGINIA 23112
TEL: (804) 763-1200 • FAX: (804) 763-0493

PLM Bulk Asbestos Report

Watts Architecture & Engineers
Attn: Ted Gorenflo
95 Perry Street
Suite 300
Buffalo, NY 14203

Date Received 11/18/2025 **AmeriSci Job #** 125111701
Date Examined 11/25/25 **P.O. #**
ELAP # 10984 **Page** 1 **of** 10
RE: 20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-01 1 **Location:** Drywall (Gray); Room 101 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 3.0%, Fibrous glass 2.0%, Non-fibrous 95%	125111701-01	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
240918-02 1 **Location:** Drywall (Gray); Room 205 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 3.0%, Fibrous glass 2.0%, Non-fibrous 95%	125111701-02	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
240918-03 2 **Location:** Drywall Joint Compound (White); Room 101 - Column **Analyst Description:** White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	125111701-03	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
240918-04 2 **Location:** Drywall Joint Compound (White); Room 205 - Wall **Analyst Description:** White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	125111701-04	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
240918-05 2 **Location:** Drywall Joint Compound (White); Room 10040 - Ceiling **Analyst Description:** White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	125111701-05	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
240918-06 3 **Location:** Ceramic Wall Tile Grout; Room 10020 **Analyst Description:** White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	125111701-06	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-07 3	125111701-07	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Ceramic Wall Tile Grout; Room 20021 **Analyst Description:** White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-08 4	125111701-08	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Ceramic Floor Tile Grout; Room 10020 **Analyst Description:** Beige/Gray, Heterogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-09 4	125111701-09	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Ceramic Floor Tile Grout; Room 20021 **Analyst Description:** Beige/Gray, Heterogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-10 5	125111701-10	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Ceramic Floor Tile Set Bed; Room 10020 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-11 5	125111701-11	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Ceramic Floor Tile Set Bed; Room 10020 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-12 6	125111701-12	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*
Location: Foil Jacket On Fiberglass Ins Domestic Plumbing; Room 101 - Above ACT **Analyst Description:** White/Silver, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 11% **Comment:** Heat Sensitive (organic): 71.8%; Acid Soluble (inorganic): 16.5%; Inert (Non-asbestos): 11.7%				

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-13 6	125111701-13	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Foil Jacket On Fiberglass Ins Domestic Plumbing; Room 101 - Above ACT
Analyst Description: White/Silver, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 19%
Comment: Heat Sensitive (organic): 71.9%; Acid Soluble (inorganic): 8.7%; Inert (Non-asbestos): 19.4%

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-14 7	125111701-14	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Foil Jacket On Fiberglass Insulated Roof Drain; Room 201
Analyst Description: White/Silver, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 37%
Comment: Heat Sensitive (organic): 54.1%; Acid Soluble (inorganic): 8.9%; Inert (Non-asbestos): 37.0%

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-15 7	125111701-15	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Foil Jacket On Fiberglass Insulated Roof Drain; Room 201 - Roof Drain Bowl
Analyst Description: White/Silver, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 30%
Comment: Heat Sensitive (organic): 50.9%; Acid Soluble (inorganic): 18.3%; Inert (Non-asbestos): 30.8%

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-16 8	125111701-16	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Foil On Fiberglass Insulated Mechanical Systems; Room 10060 - Chilled Water
Analyst Description: White/Silver, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 38%
Comment: Heat Sensitive (organic): 47.7%; Acid Soluble (inorganic): 13.6%; Inert (Non-asbestos): 38.7%

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-17 8	125111701-17	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Foil On Fiberglass Insulated Mechanical Systems; Room 10060 - Steam
Analyst Description: White/Silver, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 18%
Comment: Heat Sensitive (organic): 45.8%; Acid Soluble (inorganic): 35.8%; Inert (Non-asbestos): 18.4%

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-18 8	125111701-18	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Foil On Fiberglass Insulated Mechanical Systems; Room 10060 - Glycol
Analyst Description: 7.7688, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 20%
Comment: Heat Sensitive (organic): 53.2%; Acid Soluble (inorganic): 26.0%; Inert (Non-asbestos): 20.8%

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-19 9	125111701-19	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Exterior Soffit/Overhang; Exterior Overhang Outside Room 10040 **Analyst Description:** Gray/White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 30%, Non-fibrous 70%				
240918-20 9	125111701-20	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Exterior Soffit/Overhang; Exterior Overhang Outside Room 10040 **Analyst Description:** Gray/White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Fibrous glass 30%, Non-fibrous 70%				
240918-21 10	125111701-21	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Brick Mortar; Room 201 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-22 10	125111701-22	***No***	NAD (by NYS ELAP 198.1) by Daisha Addison on 11/25/25	
Location: Brick Mortar; Room 10041 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
240918-23 11	125111701-23	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*
Location: Duct Sealant (Gray); Room 101 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 16% **Comment:** Heat Sensitive (organic): 43.3%; Acid Soluble (inorganic): 40.3%; Inert (Non-asbestos): 16.4%				
240918-24 11	125111701-24	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*
Location: Duct Sealant (Gray); Room 101 **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 15% **Comment:** Heat Sensitive (organic): 43.2%; Acid Soluble (inorganic): 41.2%; Inert (Non-asbestos): 15.6%				

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-25 12	125111701-25	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Flange Gasket (Red, Brittle); Room 10060 - Domestic Cold
Analyst Description: Red, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 44%
Comment: Heat Sensitive (organic): 37.2%; Acid Soluble (inorganic): 18.5%; Inert (Non-asbestos): 44.3%

240918-26 12	125111701-26	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Flange Gasket (Red, Brittle); Room 10060 - Domestic Cold
Analyst Description: Red, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 44%
Comment: Heat Sensitive (organic): 34.7%; Acid Soluble (inorganic): 21.0%; Inert (Non-asbestos): 44.3%

240918-27 13	125111701-27	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Tar Coated Copper Through Wall Flashing; East Elevation
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Fibrous glass 14%
Comment: Heat Sensitive (organic): 81.9%; Acid Soluble (inorganic): 4.0%; Inert (Non-asbestos): 14.1%

240918-28 13	125111701-28	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Tar Coated Copper Through Wall Flashing; North Elevation
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Fibrous glass 8.6%
Comment: Heat Sensitive (organic): 88.0%; Acid Soluble (inorganic): 3.4%; Inert (Non-asbestos): 8.6%

240918-29 14	125111701-29	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: 4" Cove Base; Room 101
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 0.3%
Comment: Heat Sensitive (organic): 47.9%; Acid Soluble (inorganic): 51.8%; Inert (Non-asbestos): 0.3%

240918-30 14	125111701-30	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: 4" Cove Base; Room 201
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous NAD
Comment: Heat Sensitive (organic): 47.4%; Acid Soluble (inorganic): 52.6%

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-31 15	125111701-31	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Cove Base Mastic (Yellow); Room 101
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 22%
Comment: Heat Sensitive (organic): 70.2%; Acid Soluble (inorganic): 7.7%; Inert (Non-asbestos): 22.1%

240918-32 15	125111701-32	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Cove Base Mastic (Yellow); Room 101
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 27%
Comment: Heat Sensitive (organic): 68.8%; Acid Soluble (inorganic): 3.5%; Inert (Non-asbestos): 27.7%

240918-33 16	125111701-33	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Light Brown With Speck 12"x12" Floor Tile; Room 10041
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 20%
Comment: Heat Sensitive (organic): 20.5%; Acid Soluble (inorganic): 58.8%; Inert (Non-asbestos): 20.7%

240918-34 16	125111701-34	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Light Brown With Speck 12"x12" Floor Tile; Room 10040
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 20%
Comment: Heat Sensitive (organic): 17.8%; Acid Soluble (inorganic): 61.5%; Inert (Non-asbestos): 20.8%

240918-35 17	125111701-35	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Light Blue With Speck 12"x12" Floor Tile; Room 10041
Analyst Description: Blue, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 17%
Comment: Heat Sensitive (organic): 20.6%; Acid Soluble (inorganic): 62.3%; Inert (Non-asbestos): 17.1%

240918-36 17	125111701-36	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Light Blue With Speck 12"x12" Floor Tile; Room 10040
Analyst Description: Blue, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 14%
Comment: Heat Sensitive (organic): 18.8%; Acid Soluble (inorganic): 66.7%; Inert (Non-asbestos): 14.5%

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-37 18	125111701-37	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Floor Tile Mastic (Light Brown); Room 10041
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 10%
Comment: Heat Sensitive (organic): 36.4%; Acid Soluble (inorganic): 52.9%; Inert (Non-asbestos): 10.7%

240918-38 18	125111701-38	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Floor Tile Mastic (Light Brown); Room 20063
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 30%
Comment: Heat Sensitive (organic): 31.7%; Acid Soluble (inorganic): 37.8%; Inert (Non-asbestos): 30.4%

240918-39 19	125111701-39	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Ceramic Wall Tile Mastic (Light Tan); Room 20021
Analyst Description: Green, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 16%
Comment: Heat Sensitive (organic): 16.3%; Acid Soluble (inorganic): 67.5%; Inert (Non-asbestos): 16.2%

240918-40 19	125111701-40	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Ceramic Wall Tile Mastic (Light Tan); Room 20021
Analyst Description: Green, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 17%
Comment: Heat Sensitive (organic): 20.3%; Acid Soluble (inorganic): 62.1%; Inert (Non-asbestos): 17.6%

240918-41 20	125111701-41	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Carpet Square Mastic (Green); Room 101A
Analyst Description: Green, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 37%
Comment: Heat Sensitive (organic): 57.8%; Acid Soluble (inorganic): 4.9%; Inert (Non-asbestos): 37.3%

240918-42 20	125111701-42	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Carpet Square Mastic (Green); Room 101A
Analyst Description: Green, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 36%
Comment: Heat Sensitive (organic): 58.9%; Acid Soluble (inorganic): 4.5%; Inert (Non-asbestos): 36.6%

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-43 21	125111701-43	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Firestop Caulk (Dark Red); Room 10060
Analyst Description: Red, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 45%
Comment: Heat Sensitive (organic): 49.9%; Acid Soluble (inorganic): 4.6%; Inert (Non-asbestos): 45.5%

240918-44 21	125111701-44	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Firestop Caulk (Dark Red); Room 10041
Analyst Description: Red, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 42%
Comment: Heat Sensitive (organic): 52.0%; Acid Soluble (inorganic): 6.0%; Inert (Non-asbestos): 42.0%

240918-45 22	125111701-45	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Glazing Compound (Black, Sticky); Room 204 Sidelite
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 10%
Comment: Heat Sensitive (organic): 84.4%; Acid Soluble (inorganic): 4.7%; Inert (Non-asbestos): 10.9%

240918-46 22	125111701-46	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Glazing Compound (Black, Sticky); Room 20001 Door
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 24%
Comment: Heat Sensitive (organic): 66.3%; Acid Soluble (inorganic): 9.1%; Inert (Non-asbestos): 24.6%

240918-47 23	125111701-47	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Interior Caulk (Black); Room 10041 - Door Frame
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 3.2%
Comment: Heat Sensitive (organic): 75.9%; Acid Soluble (inorganic): 20.8%; Inert (Non-asbestos): 3.2%

240918-48 23	125111701-48	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Interior Caulk (Black); Room 10041 - Door Frame
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 1.0%
Comment: Heat Sensitive (organic): 75.8%; Acid Soluble (inorganic): 23.2%; Inert (Non-asbestos): 1.0%

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-49 24	125111701-49	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Light Beige); East Elevation - Window Sill
Analyst Description: Beige, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 4.4%
Comment: Heat Sensitive (organic): 43.2%; Acid Soluble (inorganic): 52.5%; Inert (Non-asbestos): 4.4%

240918-50 24	125111701-50	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Light Beige); North Elevation - Window Sill
Analyst Description: Beige, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 6.0%
Comment: Heat Sensitive (organic): 40.6%; Acid Soluble (inorganic): 53.4%; Inert (Non-asbestos): 6.0%

240918-51 25	125111701-51	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Expansion Joint Caulk (Light Tan); East Elevation
Analyst Description: Tan, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 2.3%
Comment: Heat Sensitive (organic): 52.9%; Acid Soluble (inorganic): 44.7%; Inert (Non-asbestos): 2.3%

240918-52 25	125111701-52	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Expansion Joint Caulk (Light Tan); West Elevation
Analyst Description: Tan, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 3.2%
Comment: Heat Sensitive (organic): 49.8%; Acid Soluble (inorganic): 47.0%; Inert (Non-asbestos): 3.2%

240918-53 26	125111701-53	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Black); West Elevation Door Frame
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous NAD
Comment: Heat Sensitive (organic): 62.8%; Acid Soluble (inorganic): 37.2%

240918-54 26	125111701-54	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Black); North Elevation Door Frame
Analyst Description: Black, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous NAD
Comment: Heat Sensitive (organic): 64.6%; Acid Soluble (inorganic): 35.4%

See Reporting notes on last page

PLM Bulk Asbestos Report

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
240918-55 27	125111701-55	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Light Gray); 2nd Floor Courtyard - Wall/Floor Seam
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 5.7%
Comment: Heat Sensitive (organic): 44.3%; Acid Soluble (inorganic): 50.0%; Inert (Non-asbestos): 5.7%

240918-56 27	125111701-56	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Light Gray); 2nd Floor Courtyard - Wall/Floor Seam
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 5.7%
Comment: Heat Sensitive (organic): 44.5%; Acid Soluble (inorganic): 49.8%; Inert (Non-asbestos): 5.7%

240918-57 28	125111701-57	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Gray); 2nd Floor Courtyard - Wall/Floor Seam
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 1.6%
Comment: Heat Sensitive (organic): 48.3%; Acid Soluble (inorganic): 50.1%; Inert (Non-asbestos): 1.6%

240918-58 28	125111701-58	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Daisha Addison on 11/25/25	*1*

Location: Exterior Caulk (Gray); 2nd Floor Courtyard - Wall/Floor Seam
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 0.6%
Comment: Heat Sensitive (organic): 45.4%; Acid Soluble (inorganic): 53.9%; Inert (Non-asbestos): 0.6%

Reporting Notes:

(1) NAD results by NYS 198.6 are inconclusive and are not considered non-ACM

Analyzed by: Daisha Addison
Date: 11/25/2025

Reviewed by: Cory M. Parnell

*NAD = no asbestos detected, Detection Limit <1%, Reporting Limits: CVES = 1%, 400 Pt Ct = 0.25%, 1000 Pt Ct = 0.1%; "Present" or NVA = "No Visible Asbestos" are observations made during a qualitative analysis (Not covered by NVLAP or NY ELAP accreditations); NA = not analyzed; NA/PS = not analyzed / positive stop; PLM Bulk Asbestos Analysis using Meiji, Model MT 6120 microscope, Serial #2200363, by EPA 600/R-93/116 per 40 CFR 763 (NVLAP Lab Code 101904-0) and ELAP PLM Analysis Protocol 198.1 for New York friable samples which includes quantitation of any vermiculite observed (198.6 for NOB samples) or EPA 400 pt ct by EPA 600/M4-82-020 (NYSDOH ELAP Lab # 10984); CA ELAP Lab # 2508; Note: PLM is not consistently reliable in detecting asbestos in floor coverings and similar NOB 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 New York State (also see EPA Advisory for floor tile, FR 59, 146, 38970, 8/1/94). NIST Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the laboratory. This PLM report relates ONLY to the items tested.

Client Name: Watts Architecture & Engineers

Table I
Summary of Bulk Asbestos Analysis Results by NYS ELAP 198.4

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

AmeriSci Sample #	Client Sample#	HG Area	NOB Sample Weight (gram)	NOB Heat Sensitive Organic %	NOB Acid Soluble Inorganic %	NOB Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
01	240918-01	1	----	----	----	----	NAD	NA
Location: Drywall (Gray); Room 101								
02	240918-02	1	----	----	----	----	NAD	NA
Location: Drywall (Gray); Room 205								
03	240918-03	2	----	----	----	----	NAD	NA
Location: Drywall Joint Compound (White); Room 101 - Column								
04	240918-04	2	----	----	----	----	NAD	NA
Location: Drywall Joint Compound (White); Room 205 - Wall								
05	240918-05	2	----	----	----	----	NAD	NA
Location: Drywall Joint Compound (White); Room 10040 - Ceiling								
06	240918-06	3	----	----	----	----	NAD	NA
Location: Ceramic Wall Tile Grout; Room 10020								
07	240918-07	3	----	----	----	----	NAD	NA
Location: Ceramic Wall Tile Grout; Room 20021								
08	240918-08	4	----	----	----	----	NAD	NA
Location: Ceramic Floor Tile Grout; Room 10020								
09	240918-09	4	----	----	----	----	NAD	NA
Location: Ceramic Floor Tile Grout; Room 20021								
10	240918-10	5	----	----	----	----	NAD	NA
Location: Ceramic Floor Tile Set Bed; Room 10020								
11	240918-11	5	----	----	----	----	NAD	NA
Location: Ceramic Floor Tile Set Bed; Room 10020								
12	240918-12	6	0.208	71.8	16.5	11.7	NAD	NAD
Location: Foil Jacket On Fiberglass Ins Domestic Plumbing; Room 101 - Above ACT								
13	240918-13	6	0.080	71.9	8.7	19.4	NAD	NAD
Location: Foil Jacket On Fiberglass Ins Domestic Plumbing; Room 101 - Above ACT								
14	240918-14	7	0.173	54.1	8.9	37.0	NAD	NAD
Location: Foil Jacket On Fiberglass Insulated Roof Drain; Room 201								
15	240918-15	7	0.137	50.9	18.3	30.8	NAD	NAD
Location: Foil Jacket On Fiberglass Insulated Roof Drain; Room 201 - Roof Drain Bowl								
16	240918-16	8	0.204	47.7	13.6	38.7	NAD	NAD
Location: Foil On Fiberglass Insulated Mechanical Systems; Room 10060 - Chilled Water								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results by NYS ELAP 198.4

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

AmeriSci Sample #	Client Sample#	HG Area	NOB Sample Weight (gram)	NOB Heat Sensitive Organic %	NOB Acid Soluble Inorganic %	NOB Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
17	240918-17	8	0.216	45.8	35.8	18.4	NAD	NAD
Location:	Foil On Fiberglass Insulated Mechanical Systems; Room 10060 - Steam							
18	240918-18	8	0.072	53.2	26.0	20.8	NAD	NAD
Location:	Foil On Fiberglass Insulated Mechanical Systems; Room 10060 - Glycol							
19	240918-19	9	----	----	----	----	NAD	NA
Location:	Exterior Soffit/Overhang; Exterior Overhang Outside Room 10040							
20	240918-20	9	----	----	----	----	NAD	NA
Location:	Exterior Soffit/Overhang; Exterior Overhang Outside Room 10040							
21	240918-21	10	----	----	----	----	NAD	NA
Location:	Brick Mortar; Room 201							
22	240918-22	10	----	----	----	----	NAD	NA
Location:	Brick Mortar; Room 10041							
23	240918-23	11	0.447	43.3	40.3	16.4	NAD	NAD
Location:	Duct Sealant (Gray); Room 101							
24	240918-24	11	0.291	43.2	41.2	15.6	NAD	NAD
Location:	Duct Sealant (Gray); Room 101							
25	240918-25	12	0.338	37.2	18.5	44.3	NAD	NAD
Location:	Flange Gasket (Red, Brittle); Room 10060 - Domestic Cold							
26	240918-26	12	0.302	34.7	21.0	44.3	NAD	NAD
Location:	Flange Gasket (Red, Brittle); Room 10060 - Domestic Cold							
27	240918-27	13	0.145	81.9	4.0	14.1	NAD	NAD
Location:	Tar Coated Copper Through Wall Flashing; East Elevation							
28	240918-28	13	0.163	88.0	3.4	8.6	NAD	NAD
Location:	Tar Coated Copper Through Wall Flashing; North Elevation							
29	240918-29	14	0.258	47.9	51.8	0.3	NAD	NAD
Location:	4" Cove Base; Room 101							
30	240918-30	14	0.169	47.4	52.6	0.0	NAD	NAD
Location:	4" Cove Base; Room 201							
31	240918-31	15	0.269	70.2	7.7	22.1	NAD	NAD
Location:	Cove Base Mastic (Yellow); Room 101							
32	240918-32	15	0.492	68.8	3.5	27.7	NAD	NAD
Location:	Cove Base Mastic (Yellow); Room 101							

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results by NYS ELAP 198.4

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

AmeriSci Sample #	Client Sample#	HG Area	NOB Sample Weight (gram)	NOB Heat Sensitive Organic %	NOB Acid Soluble Inorganic %	NOB Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
33	240918-33	16	0.329	20.5	58.8	20.7	NAD	NAD
Location: Light Brown With Speck 12"x12" Floor Tile; Room 10041								
34	240918-34	16	0.248	17.8	61.5	20.8	NAD	NAD
Location: Light Brown With Speck 12"x12" Floor Tile; Room 10040								
35	240918-35	17	0.245	20.6	62.3	17.1	NAD	NAD
Location: Light Blue With Speck 12"x12" Floor Tile; Room 10041								
36	240918-36	17	0.263	18.8	66.7	14.5	NAD	NAD
Location: Light Blue With Speck 12"x12" Floor Tile; Room 10040								
37	240918-37	18	0.303	36.4	52.9	10.7	NAD	NAD
Location: Floor Tile Mastic (Light Brown); Room 10041								
38	240918-38	18	0.480	31.7	37.8	30.4	NAD	NAD
Location: Floor Tile Mastic (Light Brown); Room 20063								
39	240918-39	19	0.264	16.3	67.5	16.2	NAD	NAD
Location: Ceramic Wall Tile Mastic (Light Tan); Room 20021								
40	240918-40	19	0.190	20.3	62.1	17.6	NAD	NAD
Location: Ceramic Wall Tile Mastic (Light Tan); Room 20021								
41	240918-41	20	0.245	57.8	4.9	37.3	NAD	NAD
Location: Carpet Square Mastic (Green); Room 101A								
42	240918-42	20	0.370	58.9	4.5	36.6	NAD	NAD
Location: Carpet Square Mastic (Green); Room 101A								
43	240918-43	21	0.282	49.9	4.6	45.5	NAD	NAD
Location: Firestop Caulk (Dark Red); Room 10060								
44	240918-44	21	0.238	52.0	6.0	42.0	NAD	NAD
Location: Firestop Caulk (Dark Red); Room 10041								
45	240918-45	22	0.720	84.4	4.7	10.9	NAD	NAD
Location: Glazing Compound (Black, Sticky); Room 204 Sidelite								
46	240918-46	22	0.380	66.3	9.1	24.6	NAD	NAD
Location: Glazing Compound (Black, Sticky); Room 20001 Door								
47	240918-47	23	0.460	75.9	20.8	3.2	NAD	NAD
Location: Interior Caulk (Black); Room 10041 - Door Frame								
48	240918-48	23	0.163	75.8	23.2	1.0	NAD	NAD
Location: Interior Caulk (Black); Room 10041 - Door Frame								

See Reporting notes on last page

Table I
Summary of Bulk Asbestos Analysis Results by NYS ELAP 198.4

20240918; Beebe Hall Maker Hub Renovations; Beebe Hall, Cornell University, Ithaca, NY

AmeriSci Sample #	Client Sample#	HG Area	NOB Sample Weight (gram)	NOB Heat Sensitive Organic %	NOB Acid Soluble Inorganic %	NOB Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
49	240918-49	24	0.307	43.2	52.5	4.4	NAD	NAD
Location:	Exterior Caulk (Light Beige); East Elevation - Window Sill							
50	240918-50	24	0.332	40.6	53.4	6.0	NAD	NAD
Location:	Exterior Caulk (Light Beige); North Elevation - Window Sill							
51	240918-51	25	0.441	52.9	44.7	2.3	NAD	NAD
Location:	Expansion Joint Caulk (Light Tan); East Elevation							
52	240918-52	25	0.265	49.8	47.0	3.2	NAD	NAD
Location:	Expansion Joint Caulk (Light Tan); West Elevation							
53	240918-53	26	0.120	62.8	37.2	0.0	NAD	NAD
Location:	Exterior Caulk (Black); West Elevation Door Frame							
54	240918-54	26	0.184	64.6	35.4	0.0	NAD	NAD
Location:	Exterior Caulk (Black); North Elevation Door Frame							
55	240918-55	27	0.348	44.3	50.0	5.7	NAD	NAD
Location:	Exterior Caulk (Light Gray); 2nd Floor Courtyard - Wall/Floor Seam							
56	240918-56	27	0.330	44.5	49.8	5.7	NAD	NAD
Location:	Exterior Caulk (Light Gray); 2nd Floor Courtyard - Wall/Floor Seam							
57	240918-57	28	0.504	48.3	50.1	1.6	NAD	NAD
Location:	Exterior Caulk (Gray); 2nd Floor Courtyard - Wall/Floor Seam							
58	240918-58	28	0.249	45.4	53.9	0.6	NAD	NAD
Location:	Exterior Caulk (Gray); 2nd Floor Courtyard - Wall/Floor Seam							

Analyzed by: Cory M. Parnell

Reviewed by: Cory M. Parnell

Date: 11/25/2025

Semi-Quantitative Analysis: NAD = no asbestos detected; NA = not analyzed; NA/PS = not analyzed due to positive stop; Trace = <1%; PLM analysis by EPA 600/R-93/116 per 40 CFR 763 (NVLAP Lab Code 101904-0) or NY ELAP 198.1 for New York friable samples which includes quantitation of any vermiculite observed (198.6 for NOB samples) or EPA 400 pt ct by EPA 600/M4-82-020 (NY ELAP Lab # 10984); TEM prep by EPA 600/R-93/116 Section 2.3 (analysis by Section 2.5, not covered by NVLAP Bulk accreditation); or NY ELAP 198.4 for New York NOB samples (NY ELAP Lab # 10984). Analysis using Jeol, Model JEM-100CX II microscope, Serial #156147-247. ** Warning Notes: Consider PLM fiber diameter 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, soils or other heterogeneous materials for which a combination PLM/TEM evaluation is recommended; Quantitation for beginning weights of <0.1 grams should be considered as qualitative only.

125111701

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WATTS ARCHITECTS & ENGINEERS
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY

Client: Cornell University
Project: Beebe Hall Maker Hub Renovations
Building / Location: Beebe Hall, Cornell University, Ithaca, NY
Contact: Ted Gorenflo at 716-392-4556
Preliminary Results to: tgorenflo@watts-ae.com and
Mail Report & Invoice to: Watts Architects & Engineers
95 Perry Street, Buffalo, NY 14203

Date: 11/14/2025
Watts Project No: 20240918

Analysis Requested:
198.1 X 198.4 X
198.8 198.6 X

Turnaround Requested:
3 Hr. 48 Hr.
6 Hr. 72 Hr.
12 Hr. 4 Day
24 Hr. X 5 Day

Sample Number	Material Description	HA	Sample Location	Laboratory Results PLM	Laboratory Results TEM
240918-01	Drywall (Gray)	1	Room 101		
240918-02	↓	1	Room 205		
-03	Drywall Joint Compound (White)	2	Room 101 - Column		
-04	↓	2	Room 205 - Wall		
-05	↓	2	Room 10040 - Ceiling		
-06	Ceramic Wall Tile Grout	3	Room 10020		
-07	↓	3	Room 20021		
-08	Ceramic Floor Tile Grout	4	Room 10020		
-09	↓	4	Room 20021		
-10	Ceramic Floor Tile Set Bed	5	Room 10020		
-11	↓	5	↓		
-12	Foil Jacket on Fiberglass Ins. Domestic Plumbing	6	Room 101 - Above ACT		
-13	↓	6	↓		
-14	Foil Jacket on Fiberglass Insulated Roof Drain	7	Room 201		
-15	↓	7	Room 201 - Roof Drain Bowl		
-16	Foil Jacket on Fiberglass Insulated Mechanical Systems	8	Room 10060 - Chilled Water		
-17	↓	8	Room 10060 - Steam		
-18	↓	8	Room 10060 - Glycol		

Sampled By: Ted Gorenflo Date: 11/13/25 Time: N/A Received By: Date:

Relinquished By: Ted Gorenflo Date: 11/17/25 Time: 1500 Received By: Date:

Received
NOV 18 2025

Comments: If PLM NOB is negative, analyze by TEM. Stop at first positive for each homogeneous material description group.
If Vermiculite is detected , cease analysis and contact the Watts Project Manager for further instructions.

125111701

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WATTS ARCHITECTS & ENGINEERS
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY

Client: Cornell University
Project: Beebe Hall Maker Hub Renovations
Building / Location: Beebe Hall, Cornell University, Ithaca, NY
Contact: Ted Gorenflo at 716-392-4556
Preliminary Results to: tgorenflo@watts-ae.com and
Mail Report & Invoice to: Watts Architects & Engineers
95 Perry Street, Buffalo, NY 14203

Date: 11/14/2025
Watts Project No: 20240918

Analysis Requested:
198.1 X 198.4 X
198.8 198.6 X

Turnaround Requested:
3 Hr. 48 Hr.
6 Hr. 72 Hr.
12 Hr. 4 Day
24 Hr. X 5 Day

Sample Number	Material Description	HA	Sample Location	Laboratory Results PLM	Laboratory Results TEM
240918-19	Exterior Soffit/Overhang	9	Exterior Overhang Outside Room 10040		
240918-20	↓	9	↓		
-21	Brick Mortar	10	Room 201		
-22	↓	10	Room 10041		
-23	Duct Sealant (Gray)	11	Room 101		
-24	↓	11	↓		
-25	Flange Gasket (Red, Brittle)	12	Room 10060 - Domestic Cold		
-26	↓	12	↓		
-27	Tar (aged) Copper Through Wall Flashing	13	East Elevation		
-28	↓	13	North Elevation		
-29	4" Cove Base	14	Room 101		
-30	↓	14	Room 201		
-31	Cove Base Mastic (Yellow)	15	Room 101		
-32	↓	15	↓		
-33	Light Brown with Speck 12"x12" Floor Tile	16	Room 10041		
-34	↓	16	Room 10040		
-35	Light Blue with Speck 12"x12" Floor Tile	17	Room 10041		
-36	↓	17	Room 10040		

Sampled By: Ted Gorenflo Date: 11/13/25 Time: N/A Received By: Date:
Relinquished By: Ted Gorenflo Date: 11/17/25 Time: 1500 Received By: Date: Received

Comments: If PLM NOB is negative, analyze by TEM. Stop at first positive for each homogeneous material description group.
If Vermiculite is detected, cease analysis and contact the Watts Project Manager for further instructions.

NOV 18 2025

125111701

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WATTS ARCHITECTS & ENGINEERS
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY

Client: Cornell University
Project: Beebe Hall Maker Hub Renovations
Building / Location: Beebe Hall, Cornell University, Ithaca, NY
Contact: Ted Gorenflo at 716-392-4556
Preliminary Results to: tgorenflo@watts-ae.com and
Mail Report & Invoice to: Watts Architects & Engineers
95 Perry Street, Buffalo, NY 14203

Date: 11/14/2025
Watts Project No: 20240918

Analysis Requested:
198.1 X 198.4 X
198.8 198.6 X

Turnaround Requested:
3 Hr. 48 Hr.
6 Hr. 72 Hr.
12 Hr. 4 Day
24 Hr. X 5 Day

Sample Number	Material Description	HA	Sample Location	Laboratory Results	
				PLM	TEM
240918-37	Floor Tile Mastic (Light Brown)	18	Room 10041		
240918-38	↓	18	Room 20063		
-39	Ceramic Wall Tile Mastic (Light Tan)	19	Room 20021		
-40	↓	19	↓		
-41	Carpet Square Mastic (Green)	20	Room 101A		
-42	↓	20	↓		
-43	Firestop Caulk (Dark Red)	21	Room 10060		
-44	↓	21	Room 10041		
-45	Glazing Compound (Black, Sticky)	22	Room 204 Sidelite		
-46	↓	22	Room 20001 Door		
-47	Interior Caulk (Black)	23	Room 10041 - Door Frame		
-48	↓	23	↓		
-49	Exterior Caulk (Light Beige)	24	East Elevation - Window Sill		
-50	↓	24	North Elevation - Window Sill		
-51	Expansion Joint Caulk (Light Tan)	25	East Elevation		
-52	↓	25	West Elevation		
-53	Exterior Caulk (Black)	26	West Elevation Door Frame		
-54	↓	26	North Elevation Window Frame		

Sampled By: Ted Gorenflo Date: 11/13/25 Time: N/A Received By: Date:
Relinquished By: Ted Gorenflo Date: 11/17/25 Time: 1500 Received By: Date:

Comments: If PLM NOB is negative, analyze by TEM. Stop at first positive for each homogeneous material description group.
If Vermiculite is detected, cease analysis and contact the Watts Project Manager for further instructions.

Received
NOV 18 2025

125111701

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WATTS ARCHITECTS & ENGINEERS
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY

Client: Cornell University
Project: Beebe Hall Maker Hub Renovations
Building / Location: Beebe Hall, Cornell University, Ithaca, NY
Contact: Ted Gorenflo at 716-392-4556
Preliminary Results to: tgorenflo@watts-ae.com and
Mail Report & Invoice to: Watts Architects & Engineers
95 Perry Street, Buffalo, NY 14203

Date: 11/14/2025
Watts Project No: 20240918

Turnaround Requested:
___ 3 Hr. ___ 48 Hr.
___ 6 Hr. ___ 72 Hr.
___ 12 Hr. ___ 4 Day
___ 24 Hr. X 5 Day

Analysis Requested:
198.1 X 198.4 X
198.8 ___ 198.6 X

Sample Number	Material Description	HA	Sample Location	Laboratory Results PLM	Laboratory Results TEM
240918-55	Exterior Caulk (Light Gray)	27	2nd Floor Courtyard - Wall/Floor Seam		
240918-56	↓	27	↓		
-57	Exterior Caulk (Gray)	28	↓		
-58	↓	28	↓		

Sampled By: Ted Gorenflo Date: 11/13/25 Time: N/A Received By: Date:

Relinquished By: Ted Gorenflo Date: 11/17/25 Time: 1500 Received By: Date:

Received
NOV 18 2025

Comments: If PLM NOB is negative, analyze by TEM. Stop at first positive for each homogeneous material description group.
If Vermiculite is detected , cease analysis and contact the Watts Project Manager for further instructions.

3.0 – LEAD-BASED PAINT

3.0 LEAD-BASED PAINT (LBP)

Methodology

Painted building components were grouped by testing combinations. A testing combination is characterized by location, component type, substrate, and visible color. Refer to section 3.1 for a complete listing of all XRF readings that were taken for this project. Each XRF reading is identified by the side of the building it was collected from (North, South, East and West), the component analyzed, the substrate and the paint color of the visible paint film.

The LBP survey was performed using aspects of the Department of Housing and Urban Development (HUD) protocol. Certain aspects of the HUD guidelines are typically applied to public and commercial buildings, most commonly the levels used to establish LBP. HUD defines LBP, when analyzed by a portable XRF, as paint that contains lead at 1.0 milligram per square centimeter or greater. When paint chips are analyzed by Atomic Absorption Spectroscopy (AAS), HUD defines LBP as paint containing 0.5 percent or greater (>0.5%) lead by weight.

For the purposes of this project, the Occupational Safety & Health Administration's (OSHA) Lead in Construction Standard (29 CFR 1926.62) applies. This standard applies to all construction work where an employee may be occupationally exposed to lead. Construction work is defined as work for construction, alteration and/or repair, including painting and decorating. It includes but is not limited to the following:

- Demolition or salvage of structures where lead or materials containing lead are present;
- Removal or encapsulation of materials containing lead;
- New construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead;
- Installation of products containing lead;
- Lead contamination/emergency cleanup;
- Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed; and
- Maintenance operations associated with the construction activities.

XRF Calibration

In order to field verify the calibration and accuracy of the XRF equipment, "calibration checks" are made both by the equipment itself and by the operator. Before the XRF will allow any testing for lead-based paint, it performs an internal standardization. If the standardization is successful, the operator checks the calibration of the XRF against National Institute of Standards and Technology (NIST) lead samples that were provided by the manufacturer. The operator's calibration checks are taken at the beginning and the end of the testing period,

and approximately every four hours, if necessary. The calibration checks are acceptable if the average of the three readings is between 0.8 and 1.2 mg/cm^2.

Disclaimer

This report is based primarily on the results of visual site observations and a general XRF survey of the materials that may be disturbed by the project. Watts did not perform a comprehensive inspection (room by room) of all interior and exterior surfaces and building components. Representative XRF readings were taken from each distinct building component in order to be able to determine if those components are covered with lead-based paint.

The following surfaces and/or materials were determined to be coated with and/or contain lead (greater than or equal to 1.0 mg/cm^2) and are therefore considered lead-based paint (LBP):

- Structural steel
- Exterior brown metal railings/handrails
- Rust colored metal window and door lintels

The lead-based paint survey was performed by Watts on November 13, 2025.

Ted Gorenflo
Lead Inspector

Signature

LBP-I-I242837-2
Certification Number

Address:

Beebe Hall (Facility Code 1033)
Cornell University
110 Arboretum Road
Ithaca, New York

Date of Construction: 1910

3.1 – X-RAY FLUORESCENCE (XRF) ANALYZER LEAD DATA TABLE

XRF LEAD DATA TABLE
Beebe Hall (Facility Code 1033) Maker Hub Project
Cornell University
Ithaca, New York
Testing Date: November 13, 2025 **Heuresis Corp. Pb 200i XRF Lead Paint Analyzer**

Reading	Room	Side	Component	Substrate	Color	Condition	Floor	Results (mg/cm^2)
1	Calibration							1.1
2	Calibration							1
3	Calibration							1.1
4	Calibration							0
5	Calibration							0
6	Calibration							0.1
7	102	South	Wall	Drywall	White	Intact	First	0
8	102	North	Fin Tube Radiator	Metal	Beige	Intact	First	0
9	102	North	Window Frame	Metal	Black	Intact	First	0.1
10	101	West	Wall	CMU Block	White	Intact	First	0.1
11	101	West	Door Frame	Metal	Grey	Intact	First	0.5
12	101	West	Door	Metal	Grey	Intact	First	0
13	101	West	Column	Drywall	White	Intact	First	0.1
14	101	South	Door	Metal	Grey	Intact	First	0
15	101	South	Door Frame	Metal	Grey	Intact	First	0
16	101	South	Wall	Drywall	White	Intact	First	0.1
17	101	East	Door	Metal	Black	Intact	First	0.1
18	101	East	Door Frame	Metal	Black	Intact	First	0.1
19	101	East	Threshold	Metal	Black	Intact	First	0
20	101	North	Wall	Drywall	Tan	Intact	First	0.1
21	10041	North	Wall	CMU Block	Tan	Intact	First	0.1
22	10041	North	Column	Concrete	Tan	Intact	First	0.1
23	10041	West	Door Frame	Metal	Grey	Intact	First	0
24	10041	West	Door	Metal	Grey	Intact	First	0
25	10041	West	Radiator Cover	Metal	Tan	Intact	First	0
26	10020	North	Wall	Drywall	White	Intact	First	0.1
27	10020	North	Wall Tile	Ceramic	Grey	Intact	First	0
28	10020	South	Wall Tile	Ceramic	Grey	Intact	First	0.2
29	10020	South	Floor Tile	Ceramic	Grey	Intact	First	0.3
30	10020	South	Floor Tile	Ceramic	Grey	Intact	First	0.3
31	10020	North	Sink	Porcelain	White	Intact	First	0.3
32	10020	North	Urinal	Porcelain	White	Intact	First	0.1
33	10020	North	Toilet	Porcelain	White	Intact	First	0.3
34	**10060**	**North**	**Steel Column**	**Metal**	**Black**	**Intact**	**First**	**7.5**
35	10060	North	Pump	Metal	Red	Intact	First	0.2
36	10001	South	Stair Stringer	Metal	Grey	Intact	First	0.2
37	10001	South	Stair Stringer	Metal	Grey	Intact	First	0.1
38	10001	South	Railing	Metal	Grey	Intact	First	0.1
39	10001	South	Railing	Metal	Grey	Intact	First	0
40	10001	South	Wall	CMU Block	White	Intact	First	0
41	10001	North	Wall	Brick	White	Intact	First	0.1
42	10001	North	Wall	Brick	White	Intact	First	0
43	201	West	Wall	CMU Block	White	Intact	Second	0
44	201	South	Column	Drywall	White	Intact	Second	0.1

XRF LEAD DATA TABLE
Beebe Hall (Facility Code 1033) Maker Hub Project
Cornell University
Ithaca, New York
Testing Date: November 13, 2025 **Heuresis Corp. Pb 200i XRF Lead Paint Analyzer**

Reading	Room	Side	Component	Substrate	Color	Condition	Floor	Results (mg/cm^2)
45	201	South	Fin Tube Radiator	Metal	Beige	Intact	Second	0
46	201	South	Bar Joist	Metal	White	Intact	Second	0.7
47	**201**	**South**	**Bar Joist**	**Metal**	**White**	**Intact**	**Second**	**1.2**
48	201	North	I-Beam	Metal	White	Intact	Second	1
49	201	North	I-Beam	Metal	White	Intact	Second	0.5
50	201	North	I-Beam	Metal	White	Intact	Second	0.3
51	**201**	**East**	**I-Beam**	**Metal**	**White**	**Intact**	**Second**	**1.2**
52	201	West	Ductwork	Metal	White	Intact	Second	0.1
53	201	West	Ductwork	Metal	White	Intact	Second	0.1
54	201	South	Ductwork	Metal	White	Intact	Second	0.1
55	205	North	Steel Column	Metal	White	Intact	Second	0.2
56	205	North	Ductwork	Metal	White	Intact	Second	0.1
57	205	West	Fin Tube Radiator	Metal	Beige	Intact	Second	0
58	20063	West	Sprinkler Pipe	Metal	White	Intact	Second	0.2
59	20021	North	Wall	Drywall	White	Intact	Second	0
60	20021	South	Wall Tile	Ceramic	Grey	Intact	Second	0.3
61	20021	West	Wall Tile	Ceramic	Grey	Intact	Second	0.3
62	20021	West	Floor Tile	Ceramic	Grey	Intact	Second	0.1
63	20021	West	Floor Tile	Ceramic	Grey	Intact	Second	0.1
64	20021	East	Toilet	Porcelain	White	Intact	Second	0
65	20021	East	Sink	Porcelain	White	Intact	Second	0.2
66	201	South	Stair Stringer	Metal	Grey	Intact	Second	0.1
67	201	South	Railing	Metal	Grey	Intact	Second	0
68	101	South	I-Beam	Metal	Red	Intact	Second	0
69	**101**	**South**	**Column**	**Metal**	**Black**	**Intact**	**First**	**2.7**
70	Exterior	North	Window Frame	Metal	Black	Intact	Ground	0.2
71	Exterior	West	Door Frame	Metal	Black	Intact	Ground	0.2
72	Exterior	West	Door	Metal	Black	Intact	Ground	0.1
73	Exterior	West	Lintel	Metal	Grey	Intact	Ground	0.6
74	Exterior	West	Lintel	Metal	Grey	Intact	Ground	0.7
75	**Exterior**	**South**	**Railing**	**Metal**	**Brown**	**Intact**	**Ground**	**3.1**
76	**Exterior**	**South**	**Railing**	**Metal**	**Brown**	**Intact**	**Ground**	**2.7**
77	Exterior	South	Door	Metal	Grey	Intact	Second	0.1
78	Exterior	South	Door Frame	Metal	Grey	Intact	Second	0.5
79	Exterior	South	Fence	Metal	Black	Intact	Second	0.1
80	Exterior	East	Louver	Metal	Black	Intact	Second	0.3
81	Exterior	East	Louver	Metal	Black	Intact	Second	0.2
82	Exterior	East	Louver	Metal	Black	Intact	Second	0.2
83	**Exterior**	**East**	**Lintel**	**Metal**	**Rust**	**Intact**	**Second**	**10.4**
84	**Exterior**	**East**	**Lintel**	**Metal**	**Rust**	**Intact**	**Second**	**10.1**
85	Exterior	East	Lintel	Metal	Grey	Intact	Ground	0.4
86	Exterior	East	Lintel	Metal	Grey	Intact	Ground	0.3
87	Exterior	East	Parking Line	Asphalt	Yellow	Intact	Ground	0
88	Exterior	East	Parking Line	Asphalt	White	Intact	Ground	0.3

XRF LEAD DATA TABLE
Beebe Hall (Facility Code 1033) Maker Hub Project
Cornell University
Ithaca, New York
Testing Date: November 13, 2025 **Heuresis Corp. Pb 200i XRF Lead Paint Analyzer**

Reading	Room	Side	Component	Substrate	Color	Condition	Floor	Results (mg/cm^2)
89	Calibration							1
90	Calibration							1.1
91	Calibration							1.1
92	Calibration							0.1
93	Calibration							0.1
94	Calibration							0

Readings greater than 1.0 mg/cm^2 indicate the presence of lead-based paint.

4.0 – INSPECTION PHOTOGRAPHS

Photo 1: Typical view of the first floor. No asbestos-containing materials were identified within project limits.

Photo 2: View of Room 201 on the second floor. No asbestos-containing materials were identified within project limits.

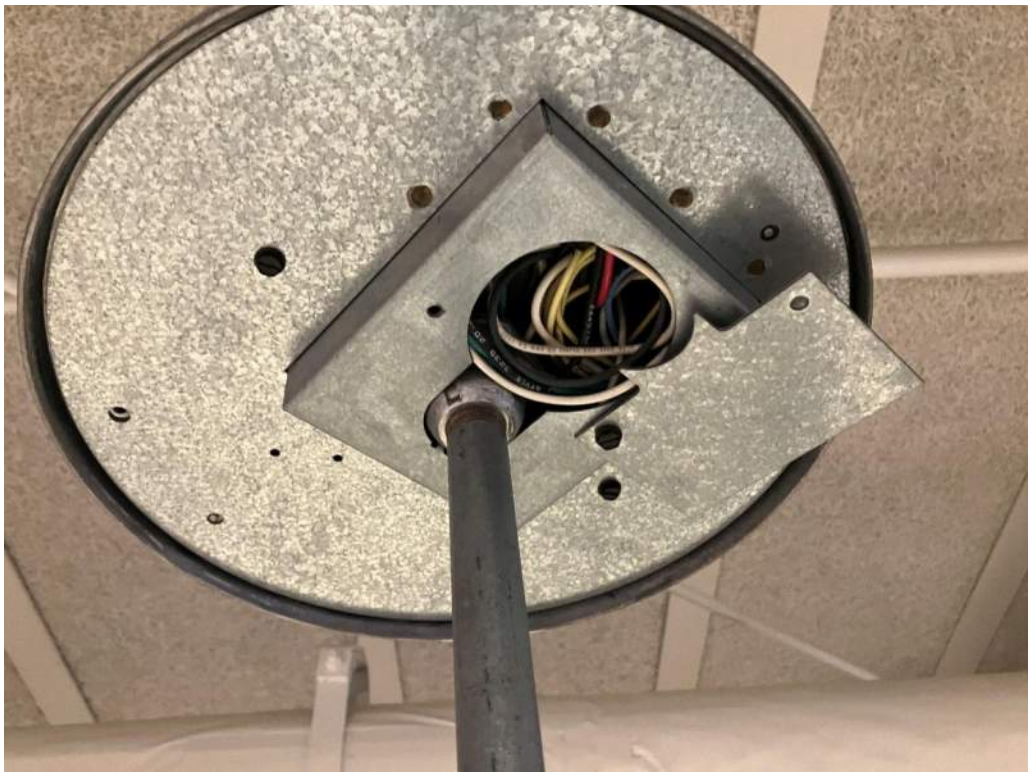


Photo 3: Wire insulation associated with the hanging light fixtures on the second floor was observed to be non-suspect thermoplastic.

Photo 4: Wire insulation associated with fluorescent light fixtures was observed to be non-suspect thermoplastic.

Photo 5: Tar coated copper through wall flashing was identified to be non-ACM.

Photo 6: Fire doors were observed to be insulated with non-suspect foam.

5.0 – LABORATORY ACCREDITATIONS

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2026
Issued April 01, 2025

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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

MR. CORY M. PARNELL
AMERISCI RICHMOND
13635 GENITO RD
MIDLOTHIAN, VA 23112

NY Lab Id No: 10984

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
Asbestos-Vermiculite-Containing Mate	Item 198.8 of Manual

Serial No.: 70357

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: 101904-0

AmeriSci Richmond

Midlothian, VA

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 on ISO/IEC 17025).

2025-07-01 through 2026-06-30

Effective Dates

For the National Voluntary Laboratory Accreditation Program

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

AmeriSci Richmond
dba AmeriSci Richmond
13635 Genito Road
Midlothian, VA 23112
Cory M. Parnell
Phone: 804-763-1200
Email: cparnell@amerisci.com
http://www.amerisci.com

ASBESTOS FIBER ANALYSIS

NVLAP LAB CODE 101904-0

Bulk Asbestos Analysis

Code	*Description*
18/A01	EPA -- 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

Airborne Asbestos Analysis

Code	*Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

For the National Voluntary Laboratory Accreditation Program

Effective 2025-07-01 through 2026-06-30

6.0 – CONSULTANT'S LICENSES AND CERTIFICATIONS

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

Watts Architecture & Engineering, D.P.C.
95 Perry Street, Suite 300, Buffalo, NY, 14203

License Number: 68007
License Class: RESTRICTED
Date of Issue: 08/21/2025
Expiration Date: 09/30/2026
Duly Authorized Representative: Kevin Janik

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

EXCELSIOR

Watts
Architects
&Engineers

United States Environmental Protection Agency

This is to certify that

Watts Architecture & Engineering

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226

In the Jurisdiction of:

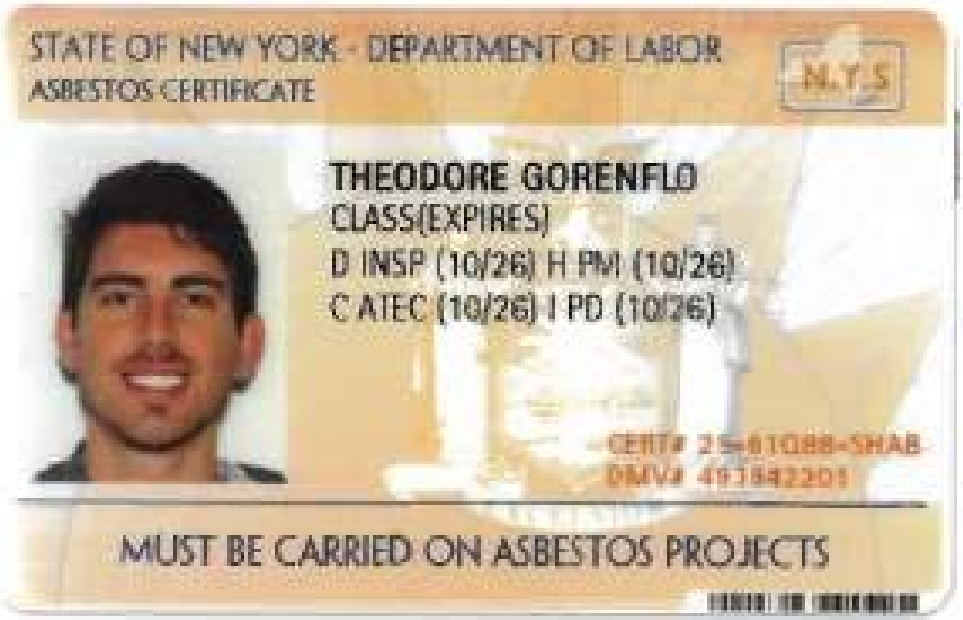
All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

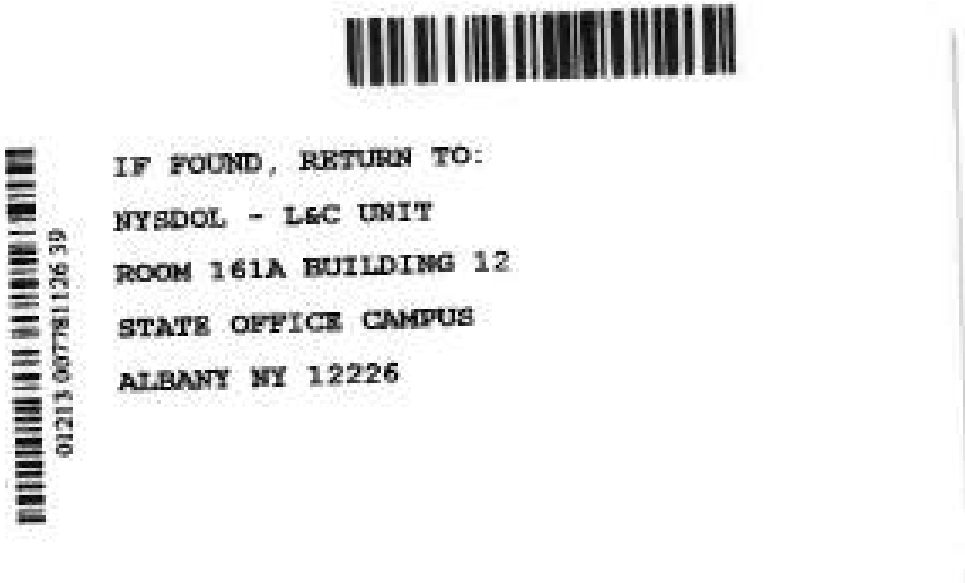
This certification is valid from the date of issuance and expires May 21, 2027

LBP-1952-3
Certification #

March 19, 2024
Issued On

Marc Edmonds, Chief
Risk Assessment Management Branch 2.





Theodore Gorenflo

C – Air Sampling Technician
D - Inspector
H – Project Monitor
I – Project Designer

United States Environmental Protection Agency

This is to certify that

Theodore Gorenflo

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as:

Inspector

In the Jurisdiction of:

All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

This certification is valid from the date of issuance and expires December 16, 2028

LBP-I-I242837-2

Certification #

October 10, 2025

Issued On

Ben Conetta, Manager

Chemicals and Multimedia Programs Branch

7.0 – LABORATORY DATA FROM PRIOR TESTING

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

PLM Bulk Asbestos Report

Delta Engineers
Attn: Stephen Prislupsky
860 Hooper Road

Endwell, NY 13760

Date Received 04/25/14 **AmeriSci Job #** 214044842
Date Examined 04/26/14 **P.O. #**
ELAP # 11480 **Page** 1 **of** 4
RE: 2014.030.167; Cornell University; Beebe Hall Walls And Ceiling Asbestos Bulk Sampling

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
2014.030.167-01A 01	214044842-01 **Location:** Floor 1 - Room 101 - Sheetrock - Wall	*No*	NAD (by NYS ELAP 198.1) by Ella Babayeva on 04/26/14
Analyst Description: White/Tan, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 15 %, Non-fibrous 85 %			
2014.030.167-01B 01	214044842-02 **Location:** Floor 1 - Room 101B - Sheetrock - Wall	*No*	NAD (by NYS ELAP 198.1) by Ella Babayeva on 04/26/14
Analyst Description: White/Tan, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 10 %, Non-fibrous 90 %			
2014.030.167-01C 01	214044842-03 **Location:** Floor 2 - Room 204 - Sheetrock - Wall	*No*	NAD (by NYS ELAP 198.1) by Ella Babayeva on 04/26/14
Analyst Description: White/Tan, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 75 %, Non-fibrous 25 %			
2014.030.167-02A 02	214044842-04 **Location:** Floor 1 - Room 101 - Joint Compound - Wall	*No*	NAD (by NYS ELAP 198.1) by Ella Babayeva on 04/26/14
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
2014.030.167-02B 02	214044842-05 **Location:** Floor 1 - Room 101B - Joint Compound - Wall	*No*	NAD (by NYS ELAP 198.1) by Ella Babayeva on 04/26/14
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

2014.030.167; Cornell University; Beebe Hall Walls And Ceiling Asbestos Bulk Sampling

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
2014.030.167-02C 02	214044842-06 **Location:** Floor 2 - Room 204 - Joint Compound - Wall	*No*	NAD (by NYS ELAP 198.1) by Ella Babayeva on 04/26/14
Analyst Description: White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
2014.030.167-03A 03	214044842-07 **Location:** Floor 1 - Room 10041 - North - Yellow Mastic From Non Suspect 4" Gray Cove Base	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 43 %			
2014.030.167-03B 03	214044842-08 **Location:** Floor 1 - Room 10041 - North - Yellow Mastic From Non Suspect 4" Gray Cove Base	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 35 %			
2014.030.167-03C 03	214044842-09 **Location:** Floor 2 - Room 204 - North - Yellow Mastic From Non Suspect 4" Gray Cove Base	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 44 %			
2014.030.167-04A 04	214044842-10 **Location:** Floor 1 - Room 101 - 2' x 4' Light Textured Ceiling Tile	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 24.8 %			
2014.030.167-04B 04	214044842-11 **Location:** Floor 1 - Room 101 - 2' x 4' Light Textured Ceiling Tile	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 19.4 %			

See Reporting notes on last page

PLM Bulk Asbestos Report

2014.030.167; Cornell University; Beebe Hall Walls And Ceiling Asbestos Bulk Sampling

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
2014.030.167-04C 04	214044842-12 **Location:** Floor 2 - Room 202 - 2' x 4' Light Textured Ceiling Tile	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 44 %			
2014.030.167-05A 05	214044842-13 **Location:** Floor 1 - Room 101 - Yellow Carpet Mastic	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 44.6 %			
2014.030.167-05B 05	214044842-14 **Location:** Floor 1 - Room 101 - Yellow Carpet Mastic	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 2.7 %			
2014.030.167-05C 05	214044842-15 **Location:** Floor 2 - Room 201 - Yellow Carpet Mastic	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 4 %			
2014.030.167-06A 06	214044842-16 **Location:** Floor 2 - Room 204 - 2' x 4' Tectum Ceiling Tile	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow/White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7 %			
2014.030.167-06B 06	214044842-17 **Location:** Floor 2 - Room 204A - 2' x 4' Tectum Ceiling Tile	*No*	NAD (by NYS ELAP 198.6) by Ella Babayeva on 04/26/14
Analyst Description: Yellow/White, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 8.1 %			

See Reporting notes on last page

PLM Bulk Asbestos Report

2014.030.167; Cornell University; Beebe Hall Walls And Ceiling Asbestos Bulk Sampling

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Reporting Notes:

Analyzed by: Ella Babayeva

*NAD/NSD =no asbestos detected; NA =not analyzed; NA/PS=not analyzed/positive stop; PLM Bulk Asbestos Analysis by EPA 600/M4-82-020 per 40 CFR 763 (NVLAP Lab Code 200546-0), ELAP PLM Method 198.1 for NY friable samples, which includes the identification and quantitation of vermiculite or 198.6 for NOB samples or EPA 400 pt ct by EPA 600/M4-82-020 (NY ELAP Lab ID11480); 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. AIHA Lab # 102843, RI Cert#AAL-094, CT Cert#PH-0786, Mass Cert#AA000054.

Reviewed By:

END OF REPORT

AmeriSci Job #: **214044842**

Client Name: Delta Engineers

Table I
Summary of Bulk Asbestos Analysis Results

2014.030.167; Cornell University; Beebe Hall Walls And Ceiling Asbestos Bulk Sampling

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	2014.030.167-01A	01	----	----	----	----	NAD	NA
Location: Floor 1 - Room 101 - Sheetrock - Wall								
02	2014.030.167-01B	01	----	----	----	----	NAD	NA
Location: Floor 1 - Room 101B - Sheetrock - Wall								
03	2014.030.167-01C	01	----	----	----	----	NAD	NA
Location: Floor 2 - Room 204 - Sheetrock - Wall								
04	2014.030.167-02A	02	----	----	----	----	NAD	NA
Location: Floor 1 - Room 101 - Joint Compound - Wall								
05	2014.030.167-02B	02	----	----	----	----	NAD	NA
Location: Floor 1 - Room 101B - Joint Compound - Wall								
06	2014.030.167-02C	02	----	----	----	----	NAD	NA
Location: Floor 2 - Room 204 - Joint Compound - Wall								
07	2014.030.167-03A	03	0.193	33.2	23.8	43.0	NAD	NAD
Location: Floor 1 - Room 10041 - North - Yellow Mastic From Non Suspect 4" Gray Cove Base								
08	2014.030.167-03B	03	0.183	33.3	31.7	35.0	NAD	NAD
Location: Floor 1 - Room 10041 - North - Yellow Mastic From Non Suspect 4" Gray Cove Base								
09	2014.030.167-03C	03	0.116	31.9	24.1	44.0	NAD	NAD
Location: Floor 2 - Room 204 - North - Yellow Mastic From Non Suspect 4" Gray Cove Base								
10	2014.030.167-04A	04	0.113	65.5	9.7	24.8	NAD	NAD
Location: Floor 1 - Room 101 - 2' x 4' Light Textured Ceiling Tile								
11	2014.030.167-04B	04	0.108	77.8	2.8	19.4	NAD	NAD
Location: Floor 1 - Room 101 - 2' x 4' Light Textured Ceiling Tile								
12	2014.030.167-04C	04	0.109	29.4	26.6	44.0	NAD	NAD
Location: Floor 2 - Room 202 - 2' x 4' Light Textured Ceiling Tile								
13	2014.030.167-05A	05	0.157	15.9	39.5	44.6	NAD	NAD
Location: Floor 1 - Room 101 - Yellow Carpet Mastic								
14	2014.030.167-05B	05	0.112	90.2	7.1	2.7	NAD	NAD
Location: Floor 1 - Room 101 - Yellow Carpet Mastic								
15	2014.030.167-05C	05	0.124	86.3	9.7	4.0	NAD	NAD
Location: Floor 2 - Room 201 - Yellow Carpet Mastic								
16	2014.030.167-06A	06	0.115	87.0	6.1	7.0	NAD	NAD
Location: Floor 2 - Room 204 - 2' x 4' Tectum Ceiling Tile								

See Reporting notes on last page

Client Name: Delta Engineers

Table I

Summary of Bulk Asbestos Analysis Results

2014.030.167; Cornell University; Beebe Hall Walls And Ceiling Asbestos Bulk Sampling

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	2014.030.167-06B	06	0.111	72.1	19.8	8.1	NAD	NAD

Location: Floor 2 - Room 204A - 2' x 4' Tectum Ceiling Tile

Analyzed by: Paul J. Mucha; Date Analyzed 4/26/2014

**Quantitative Analysis (Semi/Full); Bulk Asbestos Analysis - PLM by EPA 600/M4-82-020 per 40 CFR or ELAP 198.1 for New York friable samples or ELAP 198.6 for New York NOB samples; TEM (Semi/Full) by EPA 600/R-93/116 (not covered by NVLAP Bulk accreditation) or ELAP 198.4; for New York samples; NAD = no asbestos detected during a quantitative analysis; NA = not analyzed; Trace = <1%; 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): AIHA Lab # 102843, NVLAP Lab Code 200546-0, NYSDOH ELAP Lab ID#11480.

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).

Reviewed By:

DELTA
ENGINEERS, ARCHITECTS, & LAND SURVEYORS

2140448 42

860 Hooper Road, Endwell, NY 13760 Tel: 607.231.6600 Fax 607.231.6640
www.deltaengineers.com

Bulk Sample Data Sheet/COC

Client: Cornell University	**Delta Project No.:** 2014.030.167	**Date:** 4/24/2014
Project: Beebe Hall Walls and Ceiling Asbestos Bulk Sampling	**Client Project No.:**	**Turnaround Time:** 24 Hours
	Collected By: Thomas Ferro	

Sample Number		Material Type	Material Condition	Floor	Description / Sample Location
2014.030.167 -	01A	Misc.	Intact	1	Sheetrock - Wall - Room 101
2014.030.167 -	01B	Misc.	Intact	1	Sheetrock - Wall - Room 101B
2014.030.167 -	01C	Misc.	Intact	2	Sheetrock - Wall - Room 204
2014.030.167 -	02A	Misc.	Intact	1	Joint Compound - Wall - Room101
2014.030.167 -	02B	Misc.	Intact	1	Joint Compound - Wall - Room101B
2014.030.167 -	02C	Misc.	Intact	2	Joint Compound - Wall - Room 204
2014.030.167 -	03A	Misc.	Intact	1	Yellow Mastic From Non Suspect 4" Gray Cove Base - Room 10041 - North
2014.030.167 -	03B	Misc.	Intact	1	Yellow Mastic From Non Suspect 4" Gray Cove Base - Room 10041 - South
2014.030.167 -	03C	Misc.	Intact	2	Yellow Mastic From Non Suspect 4" Gray Cove Base - Room 204 - West

Instructions: Analyze all non-NOB samples by NYS ELAP 198.1 PLM methodology. Analyze all NOB samples initially by NYS ELAP 198.6 PLM methodology. If all samples from a given sample set are reported as non-asbestos by 198.6, analyze by NYS ELAP 198.4 TEM methodology. Stop analysis after 1st positive for a given sample set.

Email Results to wjohnson@deltaengineers.com, sprislupsky@deltaengineers.com, rcherevko@deltaengineers.com

Notes: _____

Submitted By: Thomas Ferro Thomas Ferro (Signature) **Date:** 4/24/2014

Received By: Maureen Tary (Signature) **Date:** 4/25/14

2140448 42

DELTA
ENGINEERS, ARCHITECTS, & LAND SURVEYORS

860 Hooper Road, Endwell, NY 13760 Tel: 607.231.6600 Fax 607.231.6640
www.deltaengineers.com

Bulk Sample Data Sheet/COC

Client: Cornell University	**Delta Project No.:** 2014.030.167	**Date:** 4/24/2014
Project: Beebe Hall Walls and Ceiling Asbestos Bulk Sampling	**Client Project No.:**	**Turnaround Time:** 24 Hours
	Collected By: Thomas Ferro	

Sample Number		Material Type	Material Condition	Floor	Description / Sample Location
2014.030.167 -	04A	Misc.	Intact	1	2' x 4' Light Textured Ceiling Tile - Room 101
2014.030.167 -	04B	Misc.	Intact	1	2' x 4' Light Textured Ceiling Tile - Room 101
2014.030.167 -	04C	Misc.	Intact	2	2' x 4' Light Textured Ceiling Tile - Room 202
2014.030.167 -	05A	Misc.	Intact	1	Yellow Carpet Mastic - Room 101
2014.030.167 -	05B	Misc.	Intact	1	Yellow Carpet Mastic - Room 101
2014.030.167 -	05C	Misc.	Intact	2	Yellow Carpet Mastic - Room 201
2014.030.167 -	06A	Misc.	Intact	2	2' x 4' Tectum Ceiling Tile - Room 204
2014.030.167 -	06B	Misc.	Intact	2	2' x 4' Tectum Ceiling Tile - Room 201A

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

PLM Bulk Asbestos Report

Ambient Environmental, Inc.
Attn: Joella Viscusi
828 Washington Avenue

Albany, NY 12203

Date Received 10/31/2024 **AmeriSci Job #** 224103386
Date Examined 11/05/24 **P.O. #**
ELAP # 11480 **Page** 1 **of** 4

RE: 240926AA; Bell & Spina Architects; Arboretum Road, Ithaca, NY - Beebe Hall - Roof - P23-00139.00 P Cornell Roof Survey

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
01-01 01	224103386-01	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
Location: Roof 1 / Layer 1 - Black EPDM (M) **Analyst Description:** Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 33%				
01-02 01	224103386-02	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
Location: Roof 3 / Layer 1 - Black EPDM (M) **Analyst Description:** Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 21%				
01-03 01	224103386-03	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
Location: Roof 6 / Layer 1 - Black EPDM (M) **Analyst Description:** Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14%				
02-01 02	224103386-04	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
Location: Roof 1 / Layer 2 - Black Isobaord Facing (M) **Analyst Description:** Dark Brown, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 75%, Fibrous glass 5.0%, Non-fibrous 20%				
02-02 02	224103386-05	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
Location: Roof 3 / Layer 2 - Black Isobaord Facing (M) **Analyst Description:** Dark Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 75%, Fibrous glass 5.0%, Non-fibrous 20%				
02-03 02	224103386-06	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
Location: Roof 6 / Layer 2 - Black Isobaord Facing (M) **Analyst Description:** Dark Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 75%, Fibrous glass 5.0%, Non-fibrous 20%				

See Reporting notes on last page

PLM Bulk Asbestos Report

240926AA; Bell & Spina Architects; Arboretum Road, Ithaca, NY - Beebe Hall - Roof - P23-00139.00 P Cornell Roof Survey

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
03-01 03 **Location:** Roof 1 / Layer 3 - Brown Craft Paper (M) **Analyst Description:** Black/Brown, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 0.8%	224103386-07	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
03-02 03 **Location:** Roof 4 / Layer 3 - Brown Craft Paper (M) **Analyst Description:** Black/Brown, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 1.1%	224103386-08	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
04-01 04 **Location:** Roof 1 Between SIP Joints - Gypsum Joint Fill (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	224103386-09	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
04-02 04 **Location:** Roof 4 Between SIP Joints - Gypsum Joint Fill (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	224103386-10	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
05-01 05 **Location:** Roof 2 At Wall To Roof 3 - Tar On Concrete Deck (M) **Analyst Description:** Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** Chrysotile 6.8% **Other Material:** Non-fibrous 47%	224103386-11	***Yes***	6.8% (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	
05-02 05 **Location:** Roof 2 At Wall To Roof 3 - Tar On Concrete Deck (M) **Analyst Description:** Bulk Material **Asbestos Types:** **Other Material:**	224103386-12		NA/PS	
06-01 06 **Location:** Roof 1 - Black Seamseal Caulk (M) **Analyst Description:** Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 6.6%	224103386-13	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*

See Reporting notes on last page

PLM Bulk Asbestos Report

240926AA; Bell & Spina Architects; Arboretum Road, Ithaca, NY -
Beebe Hall - Roof - P23-00139.00 P Cornell Roof Survey

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
06-02 06 **Location:** Roof 3 - Black Seamseal Caulk (M) **Analyst Description:** Black, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7.3%	224103386-14	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
07-01 07 **Location:** Roof 1 To Wall Of Roof 5 - Brown Flashing Caulk (M) **Analyst Description:** Dark Brown, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 3.3%	224103386-15	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
07-02 07 **Location:** Roof 1 To Wall Of Roof 5 - Brown Flashing Caulk (M) **Analyst Description:** Dark Brown, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 3.3%	224103386-16	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
08-01 08 **Location:** Roof 2 To Wall Of Roof 1 - Light Gray Flashing Caulk (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 7.5%	224103386-17	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
08-02 08 **Location:** Roof 2 To Wall Of Roof 1 - Light Gray Flashing Caulk (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 8.4%	224103386-18	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
09-01 09 **Location:** Roof 4 To Wall Of Roof 1 - Tan Flashing Caulk (M) **Analyst Description:** Brown, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14%	224103386-19	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*
09-02 09 **Location:** Roof 4 To Wall Of Roof 1 - Tan Flashing Caulk (M) **Analyst Description:** Brown, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 14%	224103386-20	***No***	Inconclusive - NAD (NOB by NYS ELAP 198.6) by Jared C. Clarke on 11/05/24	*1*

See Reporting notes on last page

PLM Bulk Asbestos Report

240926AA; Bell & Spina Architects; Arboretum Road, Ithaca, NY - Beebe Hall - Roof - P23-00139.00 P Cornell Roof Survey

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
11-01 11 **Location:** Roof 2 To Wall Of Roof 1 - Exterior Brick (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	224103386-21	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
11-02 11 **Location:** Roof 2 To Wall Of Roof 1 - Exterior Brick (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	224103386-22	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
12-01 12 **Location:** Roof 2 To Wall Of Roof 1 - Exterior Brick Mortar (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	224103386-23	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	
12-02 12 **Location:** Roof 2 To Wall Of Roof 1 - Exterior Brick Mortar (M) **Analyst Description:** Gray, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%	224103386-24	***No***	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 11/05/24	

Reporting Notes:

(1) NAD results by NYS 198.6 are inconclusive and are not considered non-ACM

Analyzed by: Jared C. Clarke
Date: 11/5/2024

Reviewed by: Hongyan Ran

*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 Nikon, Model Labophot2 Pol Scope, Microscope, Serial #: 466274, 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: Ambient Environmental, Inc.

Table I

Summary of Bulk Asbestos Analysis Results by NYS ELAP 198.4

240926AA; Bell & Spina Architects; Arboretum Road, Ithaca, NY - Beebe Hall - Roof - P23-00139.00 P Cornell Roof Survey

AmeriSci Sample #	Client Sample#	HG Area	NOB Sample Weight (gram)	NOB Heat Sensitive Organic %	NOB Acid Soluble Inorganic %	NOB Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
01	01-01	01	0.257	61.4	5.6	33.0	NAD	NAD
Location: Roof 1 / Layer 1 - Black EPDM (M)								
02	01-02	01	0.269	74.0	4.9	21.2	NAD	NAD
Location: Roof 3 / Layer 1 - Black EPDM (M)								
03	01-03	01	0.322	78.8	6.4	14.8	NAD	NAD
Location: Roof 6 / Layer 1 - Black EPDM (M)								
04	02-01	02	----	----	----	----	NAD	NA
Location: Roof 1 / Layer 2 - Black Isobaord Facing (M)								
05	02-02	02	----	----	----	----	NAD	NA
Location: Roof 3 / Layer 2 - Black Isobaord Facing (M)								
06	02-03	02	----	----	----	----	NAD	NA
Location: Roof 6 / Layer 2 - Black Isobaord Facing (M)								
07	03-01	03	0.142	92.8	6.4	0.8	NAD	NAD
Location: Roof 1 / Layer 3 - Brown Craft Paper (M)								
08	03-02	03	0.106	98.4	0.5	1.1	NAD	NAD
Location: Roof 4 / Layer 3 - Brown Craft Paper (M)								
09	04-01	04	----	----	----	----	NAD	NA
Location: Roof 1 Between SIP Joints - Gypsum Joint Fill (M)								
10	04-02	04	----	----	----	----	NAD	NA
Location: Roof 4 Between SIP Joints - Gypsum Joint Fill (M)								
11	05-01	05	0.472	35.6	10.2	47.4	Chrysotile 6.8	NA
Location: Roof 2 At Wall To Roof 3 - Tar On Concrete Deck (M)								
12	05-02	05	0.418	30.1	15.3	54.6	NA/PS	NA
Location: Roof 2 At Wall To Roof 3 - Tar On Concrete Deck (M)								
13	06-01	06	0.307	43.9	49.4	6.6	NAD	NAD
Location: Roof 1 - Black Seamseal Caulk (M)								
14	06-02	06	0.278	43.5	49.2	7.3	NAD	NAD
Location: Roof 3 - Black Seamseal Caulk (M)								
15	07-01	07	0.168	72.0	24.7	3.3	NAD	NAD
Location: Roof 1 To Wall Of Roof 5 - Brown Flashing Caulk (M)								
16	07-02	07	0.178	72.5	24.2	3.3	NAD	NAD
Location: Roof 1 To Wall Of Roof 5 - Brown Flashing Caulk (M)								

See Reporting notes on last page

Client Name: Ambient Environmental, Inc.

Table I
Summary of Bulk Asbestos Analysis Results by NYS ELAP 198.4

240926AA; Bell & Spina Architects; Arboretum Road, Ithaca, NY - Beebe Hall - Roof - P23-00139.00 P Cornell Roof Survey

AmeriSci Sample #	Client Sample#	HG Area	NOB Sample Weight (gram)	NOB Heat Sensitive Organic %	NOB Acid Soluble Inorganic %	NOB Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
17	08-01	08	0.118	71.1	21.4	7.5	NAD	NAD
Location: Roof 2 To Wall Of Roof 1 - Light Gray Flashing Caulk (M)								
18	08-02	08	0.278	71.7	19.9	8.4	NAD	NAD
Location: Roof 2 To Wall Of Roof 1 - Light Gray Flashing Caulk (M)								
19	09-01	09	0.190	53.5	32.2	14.3	NAD	NAD
Location: Roof 4 To Wall Of Roof 1 - Tan Flashing Caulk (M)								
20	09-02	09	0.237	53.0	32.4	14.5	NAD	NAD
Location: Roof 4 To Wall Of Roof 1 - Tan Flashing Caulk (M)								
21	11-01	11	----	----	----	----	NAD	NA
Location: Roof 2 To Wall Of Roof 1 - Exterior Brick (M)								
22	11-02	11	----	----	----	----	NAD	NA
Location: Roof 2 To Wall Of Roof 1 - Exterior Brick (M)								
23	12-01	12	----	----	----	----	NAD	NA
Location: Roof 2 To Wall Of Roof 1 - Exterior Brick Mortar (M)								
24	12-02	12	----	----	----	----	NAD	NA
Location: Roof 2 To Wall Of Roof 1 - Exterior Brick Mortar (M)								

Analyzed by: Hongyan Ran
Date: 11/5/2024

Reviewed by: Hongyan Ran

**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).

Ambient Environmental, Inc.
Comprehensive Building Science Solutions
NYS Certified WBE, SBA EDWOSB & DBE

BULK SAMPLE DATA AND CHAIN OF CUSTODY FORM

PROJECT INFORMATION

Client: Bell & Spina Architects	Project Name: P23-00139.00 P Cornell Roof Survey	Project Street Address: Arboretum Road	Client Contact: Doug Arena
Project Number: 240926AA	Inspector: Kevin Jones	Project Address City/State: Ithaca, NY	Collection Date: 10/29/2024
Sample TAT: 5 Day	Building Name: Beebe Hall	Sampling Areas: Roof	Comments: (Field) X Analyze to First Positive By Homogeneous Material X For Negative NOB PLM's, continue to TEM

BULK SAMPLE LOCATION / TYPE OF MATERIALS

Homogeneous Area Number	Bulk Sample ID Number	Sampled Material (T, S, M)	Sample Location	Friability (N/F)	Condition (G, D, SD)	Quantity (LF, SF, EA)	Homogeneous Areas	Asbestos Content (Type & %)
01	01	Black EPDM (M)	Roof 1 – Layer 1	N	G			
01	02	Black EPDM (M)	Roof 3 – Layer 1	N	G			
01	03	Black EPDM (M)	Roof 6 – Layer 1	N	G			
02	01	Black Isoboard Facing (M)	Roof 1 – Layer 2	N	G			
02	02	Black Isoboard Facing (M)	Roof 3 – Layer 2	N	G			
02	03	Black Isoboard Facing (M)	Roof 6 – Layer 2	N	G			
03	01	Brown Craft Paper (M)	Roof 1 – Layer 3	N	G			
03	02	Brown Craft Paper (M)	Roof 4 – Layer 3	N	G			
04	01	Gypsum Joint Fill (M)	Roof 1 between SIP Joints	F	G			
04	02	Gypsum Joint Fill (M)	Roof 4 between SIP Joints	F	G			
05	01	Tar on Concrete Deck (M)	Roof 2 at wall to Roof 3	N	G			
05	02	Tar on Concrete Deck (M)	Roof 2 at wall to Roof 3	N	G			
06	01	Black Seamseal Caulk (M)	Roof 1	N	G			
06	02	Black Seamseal Caulk (M)	Roof 3	N	G			

#224103386

CHAIN OF CUSTODY

Relinquished By:	Date	Time	Received By:	Date	Time
I	10/30/24	16:00		10/31/24	11:11
II					

Project Manager: C.D.	Results To: Results@ambient-env.com	Drawings: ___ Sample Locations ___ Material Locations

(T=TSI; S=Surfacing; M=Misc)

LAB INFORMATION

Lab Name	Date	Time
a. Analyzed By:	11/5/24	1:30
b. QC by:		

TAT: PO 11/5/24 7:56AM

Comments:

Ambient Environmental, Inc.
Comprehensive Building Science Solutions
NYS Certified WBE,
SBA EDWOSB & DBE

BULK SAMPLE DATA AND CHAIN OF CUSTODY FORM

PROJECT INFORMATION

Client: Bell & Spina Architects	Project Name: P23-00139.00 P Cornell Roof Survey	Project Street Address: Arboretum Road	Client Contact: Doug Arena
Project Number: 240926AA	Inspector: Kevin Jones	Project Address City/State: Ithaca, NY	Collection Date: 10/29/2024
Sample TAT: 5 Day	Building Name: Beebe Hall	Sampling Areas: Roof	Comments: (Field) X Analyze to First Positive By Homogeneous Material; X For Negative NOB PLM's, continue to TEM

BULK SAMPLE LOCATION

TYPE OF MATERIALS

Homogeneous Area Number	Bulk Sample ID Number	Sampled Material (T, S, M)	Sample Location	Friability (N/F)	Condition (G, D, SD)	Quantity (LF, SF, EA)	Homogeneous Areas	Asbestos Content (Type & %)
07	01	Brown Flashing Caulk (M)	Roof 1 to wall of Roof 5	N	G			
07	02	Brown Flashing Caulk (M)	Roof 1 to wall of Roof 5	N	G			
08	01	Light Gray Flashing Caulk (M)	Roof 2 to wall of Roof 1	N	G			
08	02	Light Gray Flashing Caulk (M)	Roof 2 to wall of Roof 1	N	G			
09	01	Tan Flashing Caulk (M)	Roof 4 to wall of Roof 1	N	G			
09	02	Tan Flashing Caulk (M)	Roof 4 to wall of Roof 1	N	G			
11	01	Exterior Brick (M)	Roof 2 at wall of Roof 1	F	G			
11	02	Exterior Brick (M)	Roof 2 at wall of Roof 1	F	G			
12	01	Exterior Brick Mortar (M)	Roof 2 at wall of Roof 1	F	G			
12	02	Exterior Brick Mortar (M)	Roof 2 at wall of Roof 1	F	G			
		#224103386						

CHAIN OF CUSTODY

Relinquished By:	Date	Time	Received By:	Date	Time
I [signature]	10/30/24	16:00	[signature]	10/31/24	11:11
II					

Project Manager: C.D.

Results To: Results@ambient-env.com

Drawings: ___ Sample Locations ___ Material Locations

(T=TSI; S=Surfacing; M=Misc)

LAB INFORMATION

Lab Name	Date	Time
a. Analyzed By: [signature]	11/01/24	1:35
b. QC by: [signature]	11/5/24	7:56AM

Comments:

EMSL Analytical, Inc.
490 Rowley Road, Depew, NY 14043
Phone/Fax: (716) 651-0030 / (716) 651-0394
http://www.EMSL.com buffalolab@emsl.com

EMSL Order: 141903224
CustomerID: WATT50
CustomerPO:
ProjectID:

Attn: **Edward Jones**
Watts Architecture & Engineering
95 Perry Street
Suite 300
Buffalo, NY 14203

Phone: (716) 206-5100
Fax: (716) 206-5199
Received: 07/10/19 8:09 AM
Analysis Date: 7/10/2019
Collected: 7/9/2019

Project: **1900732 / Beebe Hall HVAC Controls & Equipment Upgrades / 110 Plantations Road, Ithaca, NY**

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 1900732-01 *141903224-0001*		**Description** Parge coating on brick wall, Mechanical Room 10060 **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Brown		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-02 *141903224-0002*		**Description** Parge coating on brick wall, Mechanical Room 10060 **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Brown		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-03 *141903224-0003*		**Description** Parge coating on brick wall, Mechanical Room 10060 **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Brown		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-04 *141903224-0004*		**Description** White end sealant coating on fiberglass pipe insulation **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	7/11/2019	White/Yellow		45.4% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	7/11/2019	White/Yellow		45.4% Other	**None Detected**
Sample ID 1900732-05 *141903224-0005*		**Description** White end sealant coating on fiberglass pipe insulation **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	7/11/2019	White/Silver/Yellow		49.7% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	7/11/2019	White/Silver/Yellow		49.7% Other	**None Detected**

Initial Report From 07/11/2019 11:05:39

EMSL Analytical, Inc.
490 Rowley Road, Depew, NY 14043
Phone/Fax: (716) 651-0030 / (716) 651-0394
http://www.EMSL.com buffalolab@emsl.com

EMSL Order: 141903224
CustomerID: WATT50
CustomerPO:
ProjectID:

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non-Fibrous	Asbestos
Sample ID 1900732-06 *141903224-0006*		**Description** White paper and foil on fiberglass pipe insulation **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	White/Silver	50.00% Cellulose 2.00% Glass	48.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-07 *141903224-0007*		**Description** White paper and foil on fiberglass pipe insulation **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	White/Silver	50.00% Cellulose 2.00% Glass	48.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-08 *141903224-0008*		**Description** Paper and silver foil jacket on fiberglass bat on HVAC duct **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Brown/Silver/	40.00% Cellulose 20.00% Glass	40.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-09 *141903224-0009*		**Description** Paper and silver foil jacket on fiberglass bat on HVAC duct **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Brown/Silver/	40.00% Cellulose 20.00% Glass	40.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-10 *141903224-0010*		**Description** White 2' x 4' rough finish suspended ceiling tiles in grid **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	7/11/2019	Gray		68.9% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	7/11/2019	Gray		68.9% Other	**None Detected**
Sample ID 1900732-11 *141903224-0011*		**Description** White 2' x 4' rough finish suspended ceiling tiles in grid **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	7/11/2019	Gray/White		70.6% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	7/11/2019	Gray/White		70.6% Other	**None Detected**

Initial Report From 07/11/2019 11:05:39

EMSL Analytical, Inc.
490 Rowley Road, Depew, NY 14043
Phone/Fax: (716) 651-0030 / (716) 651-0394
http://www.EMSL.com buffalolab@emsl.com

EMSL Order:	141903224
CustomerID:	WATT50
CustomerPO:	
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non-Fibrous	Asbestos
Sample ID 1900732-12 *141903224-0012*		**Description** Drywall, wall construction **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Gray	6.00% Cellulose	94.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-13 *141903224-0013*		**Description** Drywall, wall construction **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Gray	5.00% Cellulose	95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-14 *141903224-0014*		**Description** Joint compound on drywall **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-15 *141903224-0015*		**Description** Joint compound on drywall **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-16 *141903224-0016*		**Description** Gray flange sealant on bare HVAC duct **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	7/11/2019	Gray		21.8% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	7/11/2019	Gray		21.8% Other	**None Detected**
Sample ID 1900732-17 *141903224-0017*		**Description** Gray flange sealant on bare HVAC duct **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	7/11/2019	Gray		16.8% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	7/11/2019	Gray		16.8% Other	**None Detected**

Initial Report From 07/11/2019 11:05:39

EMSL Analytical, Inc.
490 Rowley Road, Depew, NY 14043
Phone/Fax: (716) 651-0030 / (716) 651-0394
http://www.EMSL.com buffalolab@emsl.com

EMSL Order:	141903224
CustomerID:	WATT50
CustomerPO:	
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non-Fibrous	Asbestos
Sample ID 1900732-18 *141903224-0018*		**Description** White tectum ceiling panel **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Tan/White	40.00% Cellulose	60.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1900732-19 *141903224-0019*		**Description** White tectum ceiling panel **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	7/10/2019	Tan/White	40.00% Cellulose	60.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

Analyst(s)
Shauna Strnad
Tom Hanes

Rhonda McGee

Rhonda McGee, Laboratory Manager
or other approved signatory

NOB = Non Friable Organically Bound N/A = Not Applicable VCM = Vermiculite Containing Material

-In New York State, TEM is currently the only method that can be used to determine if NOB materials can be considered or treated as non-asbestos containing.
All samples examined for the presence of vermiculite when analyzed via NYS 198.1.
-NYS Guidelines for Vermiculite containing samples are available at http://www.wadsworth.org/labcert/elapcert/forms/VermiculiteInterimGuidance_Rev070913.pdf
EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples were received in good condition unless otherwise noted.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. This report may contain data that is not covered by the NVLAP accreditation.

Samples analyzed by EMSL Analytical, Inc. Depew, NY NYS ELAP 11606

Initial Report From 07/11/2019 11:05:39

WATTS ARCHITECTURE & ENGINEERING
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY

141903224

Client: Cornell University
Project: Beebe Hall HVAC Controls & Equipment Upgrades
Building / Location: 110 Plantations Road, Ithaca, NY
Contact: Edward J. Jones at (716) 206-5142
Preliminary Results to: ejones@watts-ae.com
Mail Report & Invoice to: Watts Architecture & Engineering
95 Perry Street, Buffalo, NY 14203

Date: Tuesday July 9, 2019
Watts Project No.: 1900732

Analysis Requested:
198.1 x
198.6 x
198.4 x

Turnaround Requested:
3 Hr.
6 Hr.
12 Hr.
X 24 Hr.
48 Hr.
72 Hr.
4 Day
5 Day
7 Day

Sample Number	Material Description	HA	Sample Location	Laboratory Results PLM	Laboratory Results TEM
1900732-01	Parge coating on brick wall, Mechanical Room 10060	1	Mechanical Room brick wall with control panels		
1900732-02	Parge coating on brick wall, Mechanical Room 10060	1	Mechanical Room brick wall with control panels		
1900732-03	Parge coating on brick wall, Mechanical Room 10060	1	Mechanical Room brick wall with control panels		
1900732-04	White end sealant coating on fiberglass pipe insulation	2	Mechanical Room 10060 HW supply to main AC-1 center of room		
1900732-05	White end sealant coating on fiberglass pipe insulation	2	Mechanical Room 10060 condensate line to Condensate pump CP-1		
1900732-06	White paper and foil on fiberglass pipe insulation	3	Mechanical Room 10060 HW supply to main AC-1 center of room		
1900732-07	White paper and foil on fiberglass pipe insulation	3	Mechanical Room 10060 condensate line to Condensate pump CP-1		
1900732-08	Paper and silver foil jacket on fiberglass bat on HVAC duct	4	Mechanical Room 10060 main return air HVAC duct no pin mastic		
1900732-09	Paper and silver foil jacket on fiberglass bat on HVAC duct	4	Mechanical Room 10060 main return air HVAC duct no pin mastic		
1900732-10	White 2' x 4' rough finish suspended ceiling tiles in grid	5	First floor Room 101 by break area 101C		
1900732-11	White 2' x 4' rough finish suspended ceiling tiles in grid	5	Second floor room 201 by Room 202A		
1900732-12	Drywall, wall construction	6	First floor Room 101 by break area 101C		
1900732-13	Drywall, wall construction	6	Second floor room 201 by Room 202A		
1900732-14	Joint compound on drywall	7	First floor Room 101 by break area 101C		
1900732-15	Joint compound on drywall	7	Second floor Room 202 wall by Room 202D		
1900732-16	Gray flange sealant on bare HVAC duct	8	First floor round duct above ceiling tiles, Room 101 by break area 101C		
1900732-17	Gray flange sealant on bare HVAC duct	8	Second floor rectangular duct above ceiling tiles, Room 202 center area		
1900732-18	White Tectum ceiling panel	9	Second floor main room 201 on ceiling deck		
1900732-19	White Tectum ceiling panel	9	Second floor main room 201 on ceiling deck		

Sampled By: Edward Jones **Date:** 07/09/19 **Received By:** _____ **Date:** _____
Relinquished By: Edward Jones **Date:** 07/10/19 08:00 AM **Received By:** _____ **Date:** _____

Comments: If PLM NOB is negative, analyze by TEM. Stop at first positive for each homogeneous material description group.
If Vermiculite is detected , cease analysis and contact the Watts Project Manager for further instructions.

RECEIVED
JUL 10 2019
BY: MM

8:09am
WT

OrderID: 141903224

EMSL Analytical, Inc.

2975 Brighton Henrietta Town Line Rd ,100 Ste 130 Rochester, NY 14623
Tel/Fax: (585) 957-9436 / (585) 957-9437
http://www.EMSL.com / rochesterlab@EMSL.com

EMSL Order: 532301600
Customer ID: WATT50
Customer PO:
Project ID:

Attention: Watts Architecture & Engineering
95 Perry Street
Suite 300
Buffalo, NY 14203

Phone: (716) 206-5100
Fax: (716) 206-5199
Received Date: 09/13/2023 8:45 AM
Analysis Date: 09/13/2023 - 09/14/2023
Collected Date: 09/12/2023

Project: Project #20230646 - Beebe Hall - HVAC Controls & Related Equipment Upgrade Support, 110 Plantations Rd, Ithaca, NY.

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos
Sample ID 20230646-01 *532301600-0001*		**Description**	Mechanical room, at pipe endcaps - White Pipe Sealant		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	09/13/2023	White/ Yellow	1.30% Fibrous (other) 4.30% Glass	94.40% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	09/14/2023	White/ Yellow		100.00% Other	**None Detected**
Sample ID 20230646-02 *532301600-0002*		**Description**	Mechanical room, at pipe endcaps - White Pipe Sealant		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	09/13/2023	White/ Yellow	1.30% Fibrous (other) 4.40% Glass	94.30% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	09/14/2023	White/ Yellow		100.00% Other	**None Detected**
Sample ID 20230646-03 *532301600-0003*		**Description**	mechanical room, chilled water return line (fiberglass) - White/Silver Pipe Wrap		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	09/13/2023	White/ Silver	4.90% Glass	95.10% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	09/14/2023	White/ Silver		100.00% Other	**None Detected**
Sample ID 20230646-04 *532301600-0004*		**Description**	mechanical room, chilled water return line (fiberglass) - White/Silver Pipe Wrap		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	09/13/2023	White/ Silver	5.60% Glass	94.40% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	09/14/2023	White/ Silver		100.00% Other	**None Detected**

Initial report from: 09/14/2023 10:28:32

EMSL Analytical, Inc.

2975 Brighton Henrietta Town Line Rd ,100 Ste 130 Rochester, NY 14623
Tel/Fax: (585) 957-9436 / (585) 957-9437
http://www.EMSL.com / rochesterlab@EMSL.com

EMSL Order:	532301600
Customer ID:	WATT50
Customer PO:	
Project ID:	

Test Report:Asbestos Analysis of Bulk Material

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via NYS ELAP Approved Methods. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date:	9/13/2023	Sample Receipt Time:	8:45 AM
Analysis Completed Date:	9/13/2023	Analysis Completed Time:	2:07 PM

Analyst(s):

Thomas Hawley PLM NYS 198.6 NOB (4)

Peter Donato TEM NYS 198.4 NOB (4)

Samples reviewed and approved by:

Peter Donato, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Analytical, Inc. Rochester, NY NYS ELAP 12088, NVLAP Lab Code 600183-0

Initial report from: 09/14/2023 10:28:32

WATTS ARCHITECTURE & ENGINEERING
ASBESTOS BULK SAMPLE CHAIN-OF-CUSTODY

532301600

Page: ____ **of** ____

Client: Cornell University (Geneva Campus)
Project: Beebe Hall - HVAC Controls & Related Equipment Upgrade Support
Building / Location: 110 Plantations Rd, Ithaca NY
Contact: Ted Knapp **at (585) 297-0749**
Preliminary Results to: tknapp@watts-ae.com
Mail Report & Invoice to: **Watts Architecture & Engineering**
95 Perry Street, Buffalo, NY 14203

Date: 9/12/2023
Watts Project No.: 20230646

Analysis Requested:
198.1 x 198.6 x
198.4 x

Turnaround Requested:
____ 3 Hr. ____ 48 Hr.
____ 6 Hr. ____ 72 Hr.
____ 12 Hr. ____ 5 Day
X 24 Hr. ____ 6-10 Day

Sample Number	Material Description	[illegible]	Sample Location	Laboratory Results PLM	TEM
20230646-01	White Pipe Sealant	1	Mechanical room, at pipe endcaps		
20230646-02	White Pipe Sealant	1	Mechanical room, at pipe endcaps		
20230646-03	White/Silver Pipe Wrap	2	mechanical room, chilled water return line (fiberglass)		
20230646-04	White/Silver Pipe Wrap	2	mechanical room, chilled water return line (fiberglass)		

Sampled By: Ted Knapp **Date:** 9/12/23 **Received By:** ____ **Date:** ____
Relinquished By: Ted Knapp **Date:** 9/13/2023 **Received By:** ____ **Date:** ____

Comments: If PLM NOB is negative, analyze by TEM. Stop at first positive for each homogeneous material description group.
If Vermiculite is detected in a sample cease analysis on that sample immediately and contact the Watts Project Manager for further instructions.

OrderID: 532301600

SECTION 01 35 43 GENERAL ENVIRONMENTAL REQUIREMENTS

1.0 GENERAL

1.1 DESCRIPTION

A. This Section and the listed Related Sections provides minimum requirements for the protection of the environment during the project. The requirements of this Section shall apply to both Contractor and all tiers of Subcontractors involved in the project.

B. In addition to the requirements of this Section and the listed Related Sections, all laws and regulations by applicable local, state, and federal agencies shall apply to the Work of this Contract. In some cases the requirements of these Specifications may by intention exceed such legal requirements, but in no case shall this Specification be interpreted or understood to reduce or eliminate such requirements.

C. Prior to bidding, review the entire Bidding Documents and report in writing to the Owner's Representative any error, inconsistency, or omission that may have environmental impacts.

1.2 RELATED SECTIONS

A. Section 01 35 44 – Spill Control

B. Section 01 35 45 – Refrigerant Compliance

C. Section 01 57 13 – Soil Erosion and Sediment Control

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittals:

1. Contractor's Waste Material Disposal Plan.

2. Proposed methods for dewatering and construction water management.

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).

D. Ithaca Fire Department Permitting:

1. A permit is required from the Ithaca Fire Department to install or substantially repair a fire suppression, fire detection, or fire alarm system as such as defined under the Uniform Code of New York State.

2. If the scope of work is classified under the Existing Building Code of NYS as Alteration –Level 1; Alteration – Level 2; Alteration – Level 3; or Addition; a permit from the Ithaca Fire Department is required for all work affecting the fire suppression, fire detection, or fire alarm system for that building. A building permit is also required for this type of work.

3. Work classified as a 'Repair' under the Existing Building Code of NYS does not require a permit from the Ithaca Fire Department.

1.2 INSPECTIONS

A. Apply for and obtain all required inspections, pay all fees and charges for same, include all service charges and other associated costs.

1.3 COMPLIANCE

A. The Contractor shall give all notices, pay all fees and comply with all laws, rules and regulations applicable to the Work.

1. 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:

1. NYS Uniform Code
    a. International Building Code
    b. International Residential Code
    c. International Existing Building Code
    d. International Fire Code
    e. International Plumbing Code
    f. International Mechanical Code
    g. International Fuel Gas Code
    h. International Property Maintenance Code
    i. Uniform Code Supplement
2. NYS Energy Code
    a. International Energy Conservation Code
    b. ASHRAE 90.1
    c. Energy Code Supplement
3. National Electric Code
4. Occupational Safety and Health Administration (OSHA).
5. Life Safety Code NFPA 101.
6. All local ordinances
7. Plans and Specifications in excess of code requirements and not contrary to same.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and other Division 1 Specification Sections, apply to this Section.

1.3 DEFINITIONS

A. "General": Basic Contract definitions are included in the Conditions of the Contract.

B. "Contract Documents": The Contract Documents consist of the Agreement between Owner and Contractor, General Conditions, General Requirements, Drawings, Specifications, addenda issued before execution of the Agreement, other documents listed in the Agreement, and modifications issued after execution of the Agreement.

C. "The Contract": The Contract Documents form the Contract for construction and represent the entire integrated Agreement between the Owner and Contractor.

D. "The Work": The work comprises the completed construction required by the Contract Documents and includes all labor necessary to produce such construction and all materials and equipment incorporated in such construction.

E. "Owner": Cornell University a New York corporation.

F. "Architect/Engineer": The Architect or Engineer is the person lawfully licensed to practice architecture and/or engineering in the state of New York, identified as such in the Owner Contractor Agreement, and is referred to throughout the Contract Documents as if singular in number. The terms Architect and/or Engineer mean the Architect and/or his authorized representative.

G. "Contractor": The Contractor, person, firm, or corporation with whom the Construction Agreement contract is made by Owner.

H. "Subcontractor": A person, firm, or corporation, supplying labor and/or materials for work at site of the project for and under separate contract or agreement with Contractor.

I. "Delegated Design" describes a collaboration between a design professional and contractor (or subcontractor) where the contractor assumes allocated responsibility for an element or portion of the Project's design. Delegated design allocation and assignment may occur in any project delivery method and will involve a licensed professional to perform the design. The Contractor or Subcontractor allocated an element or portion of the Project's design, will submit its engineered, stamped plans to the primary design team, who will check for any conflicts with any other aspect of the Work and make new documents to be included in the Project's design record. Contractor or Subcontractor allocated a delegated design element of the Project shall provide professional liability insurance for the design work in such amounts and as is required by Owner.

J. "As Approved" or "Approved": Architect's or Owner's approval.

K. "As Directed": Owner's direction or instruction. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

L. “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as “indicated.”

M. “Regulations”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

N. “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

O. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

P. “Reinstall”. To place back into a former position.

Q. “Replace”. Provide a substitute for.

R. “Provide”: Furnish and install, complete and ready for the intended use.

S. “Concealed’: Work installed in pipe shafts, chases or recesses, behind furred walls, above ceilings, either permanent or removable.

T. “Exposed”: All capital Work not identified as concealed.

U. “Project Site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

V. “As-Built Documents”: Drawings and other records that are maintained by the Contractor to record all conditions which exist when the building construction is completed. This includes both the elements of the project itself and existing elements that are encountered during the course of project construction.

W. “Record Drawings”: Shows construction changes in the project and the final location of all services, lines, outlets, and connections including underground and concealed items. The “record” drawings shall be compiled by the Architect based on the working as-built drawings and revised in accordance with the marked up drawings submitted by the Contractor.

X. “Shop Drawings”: Drawings, diagrams, illustrations, charts, brochures, and other data that are prepared by Contractor or any Subcontractor, manufacturer, supplier or distributor, for some portion of the Work.

Y. “Samples”: Physical examples furnished to illustrate materials, equipment or workmanship, and to establish standards by which the work will be judged.

Z. “General Conditions”: The standardized contractual provisions describing the responsibilities, rights and relationships of the Owner and Contractor under the construction contract.

AA. "Contract Limit Lines": A limit line or perimeter line established on the drawings or elsewhere in the contract documents defining the boundaries of the site available to the contractor for construction purposes.

BB. "to do", "provide", "furnish", "install", etc., in these Specifications or on Drawings are directions given to the Contractor;

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the organizations responsible for the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil Available from Defense Standardization Program www.dps.dla.mil Available from General Services Administration www.gsa.gov	(215) 697-6257 (202) 619-8925

	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

1.5 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700

AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800

ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(334) 874-9800
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(800) 242-7405 (813) 979-1991
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312

CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSI	Cast Stone Institute www.caststone.org	(770) 972-3011
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945

EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FMG	FM Global www.fmglobal.com	(401) 275-3000
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IBR	Institute of Boiler & Radiation Manufacturers	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830

IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek www.intertek.com	(800) 345-3851 (713) 407-3500
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (804) 314-8955
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333

MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698

NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	International Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930

NYBFU	New York Board of Fire Underwriters www.nybfu.org	(212) 227-3700
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network www.landcarenetwork.org	(800) 395-2522
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SBI	Steel Boiler Institute	
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075

SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010

TPI	Turfgrass Producers International www.turfgrasssod.org	(847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UFPO	Underground Facilities Protective Organization www.ufpo.org	(800) 962-7962 (800) 962-7811
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCSC	Window Covering Safety Council www.windowcoverings.org	(800) 506-4636
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301
WI	Woodwork Institute www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100

ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
NEC	National Electric Code	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000

NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

2.0 PRODUCTS - NOT USED

3.0 EXECUTION - NOT USED

*****END OF SECTION 01 42 00*****

SECTION 01 45 00 QUALITY CONTROL

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide and maintain an effective Contractor Quality Control (CQC) program and perform sufficient inspections and tests of all items of Work, including those of Subcontractors, to ensure compliance with Contract Documents. Include surveillance and tests specified in the technical sections of the Specifications. Furnish appropriate facilities, instruments, and testing devices required for performance of the quality control function. Controls must be adequate to cover construction operations and be keyed to the construction sequence. Construction shall not begin until the Owner has approved the CQC program.

1.2 CONTROL OF ON-SITE CONSTRUCTION

A. Include a control system for the following phases of inspection:

1. Pre-Installation Meeting. For all sections where pre-installations are defined, the Contractor shall arrange for a pre-installation meeting. When practical, pre-installation meetings shall be scheduled to take place on the same day as regularly schedule progress meetings. The Contractor shall make available, during this meeting, all approved submittals and products.

    a. Agenda to include the following:

        i. Appointment

        ii. Appointment of official representatives of participants in the Project.

        iii. Review of existing conditions and affected work, and testing thereof as required.

        iv. Review of installation procedures and requirements.

        v. Review of environmental and site condition requirements.

        vi. Schedule of the applicable portions of the Work.

        vii. Schedule of submission of samples, color chips, and items for Owners consideration.

        viii. Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences, Section 01 50 00.

        ix. Requirements for notification for reviews. Allow a minimum of 48 hour notice to Architect for review of the Work.

x. Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests in accordance with Section 01 41 00.

xi. Delivery schedule of specified equipment.

xii. Special safety requirements and procedures.

b. The following minimum personnel shall be at the meeting:

i. Project Manager.

ii. Project Field Supervisor

iii. Subcontractor

iv. Architect's Representative

v. Owner's Representative

vi. Commissioning Agent, when applicable

vii. Testing Agency, when applicable

2. Preparatory Inspection. Perform this inspection prior to beginning work on any definable feature of Work. Include a review of contract requirements with the supervisors directly responsible for the performance of the Work; check to assure that materials, products, and equipment have been tested, submitted, and approved; check to assure that provisions have been made for required control testing; examine the work area to ascertain that preliminary work has been completed; physically examine materials and equipment to assure that they conform to shop drawings and data and that the materials and equipment are on hand.

3. Initial Inspection. Perform this inspection as soon as work commences on a representative portion of a particular feature of workmanship review control testing for compliance with contract requirements.

4. Follow-up Inspections. Perform these inspections on a regular basis to assure continuing compliance with contract requirements until completion of that particular work.

1.3 CONTROL OF OFF-SITE OPERATIONS

A. Perform factory quality control inspections for items fabricated or assembled off-site as opposed to "off-the-shelf" items. The CQC Representative at the fabricating plant shall be responsible for release of the fabricated items for shipment to the job site. The CQC Representative at the job site shall receive the item and note any damage incurred during shipment. The Contractor shall be responsible for protecting and maintaining the item in good condition throughout the period of on-site and during erection or installation. Although any item found to be faulty may be rejected before its use, final acceptance of an item by the Owner is based on its satisfactory incorporation into the Work and acceptance of the completed Project.

1.4 TESTING

A. The Owner may engage the services of an independent testing laboratory to confirm that an installed item or element of work conforms to the Specification and workmanship requirements.

1.5 OWNER'S REPRESENTATIVE

A. The Owner shall designate a Representative to monitor the progress and execution of the Work. The Representative shall have the authority to call for test samples, to approve or to reject work performed and to stop work in progress, if, in its opinion, the work is not in conformance with the Contract Documents. The Representative shall not be authorized to make changes or interpretations of the Contract Documents.

1. The Contractor shall maintain a project Deficiency/Issues Log in the ePM system to track non-conforming materials or sub-standard workmanship identified by Owner's Representative.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 45 00*****

SECTION 01 45 29 TESTING LABORATORY SERVICES

1.0 GENERAL

1.1 DESCRIPTION

A. The Owner will employ and pay for the services of an Independent Testing Laboratory to perform specified services.

1. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

B. Testing Laboratory services are specified in connection with work including but not limited to the following:

1. New York State Building Code, Chapter 17, Special Inspections

2. Concrete Reinforcement: Section 03 20 00.

3. Cast-in-place Concrete: Section 03 30 00.

4. Excavating, Filling & Grading: Section 31 23 33.

1.2 QUALIFICATIONS OF LABORATORY

A. Meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E329-05b, "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing ".

C. Authorized to operate in the State of New York.

D. Testing and inspections shall be performed under the direction of Licensed Professional Engineer registered in the State of New York who shall be responsible for administering all testing and inspections and shall certify any local agency requirements.

E. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

F. Testing Equipment:

1. Calibrated at maximum 12 month intervals by devices of accuracy traceable to either:

a. National Bureau of Standards

b. Accepted values of natural physical constants.

2. Submit copy of certificate of calibration made by accredited calibration agency.

1.3 LABORATORY DUTIES

A. Cooperate with Owner, Architect and Contractor; provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction.

1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

2. Ascertain compliance of materials with requirements of Contract Documents.

C. Promptly notify Owner, Architect and Contractor of observed irregularities or deficiencies of work or products.

D. Should Laboratory tests of material performed at specified intervals of time indicate that strengths do not meet Specification requirements, the Inspection Agency and Geotechnical Engineer shall IMMEDIATELY notify the Owner, Contractor, and Architect. The Architect shall determine whether remedial action is necessary.

E. Promptly submit written report of each test and inspection; one copy each to Architect, Owner, Contractor, and one copy to Record Documents File. Each report shall include:

1. Date issued.

2. Project title and number.

3. Testing laboratory name, address and telephone number.

4. Name and signature of laboratory inspector.

5. Date and time of sampling or inspection.

6. Record of temperature and weather conditions.

7. Date of test.

8. Identification of product and specification section.

9. Location of sample or test in the Project.

10. Type of inspection or test.

11. Observations on compliance with Contract Documents.

F. Prepare a summary report for each category of inspection certifying that the work has been inspected and meets the Contract Documents. Specifically list all discrepancies found which have not yet been repaired or resolved.

G. Perform additional tests as required by Architect or the Owner.

1.4 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel. Provide access to Work, and Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and for which testing is specified.

C. Provide to the laboratory the approved design mixes proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Furnish copies of Products test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.

2. To obtain and handle samples at the Project site or at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For Laboratory's exclusive use for storage and curing of test samples.

F. Notify laboratory a minimum of 24 hours in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse laboratory for personnel and travel expenses incurred due to Contractor's responsibility.

G. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience.

H. Employ and pay for the services of a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with Contract Documents.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 45 29*****

SECTION 01 45 33 CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

1.0 GENERAL

1.1 REQUIREMENTS

A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the *Building Code of New York State* (BCNYS).

B. Hold a Special Inspections preconstruction meeting at least seven (7) days prior to the initial planned date for start of construction.

1. Discussion shall include the following:

a. Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.

b. Responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Registered Design Professional.

c. Notification and reporting procedures.

2. Attendees shall include the Contractor, Owner's representative, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and for Architecture.

1.2 DEFINITIONS

A. Registered Design Professional: The licensed Professional Engineer or Registered Architect whose seal appears on the Construction Drawings.

B. Code Enforcement Official: The Officer or other designated authority charged with administration and enforcement of the BCNYS.

C. Testing/Inspecting Agency: An agent retained by the Special Inspector or by the Owner and coordinated by the Special Inspector, to perform some of the inspection services on behalf of the Special Inspector. (An example of an Inspecting Agent is a Geotechnical Engineer.)

D. Statement of Special Inspections: A document prepared by the Registered Design Professional and filed with and approved by the Code Enforcement Official that includes the Schedule of Special Inspections listing the materials and work requiring Special Inspections. This document includes the inspections and verifications required for the project and the individuals, agencies, and/or firms who will be retained to perform these services.

E. Continuous Special Inspection: The full-time observation of work by the Special Inspector or Testing Agency while the work is being performed.

F. Periodic Special Inspections: The part-time or intermittent observation of work by the Special Inspector or Testing Agency for work that has been or is being performed and at the completion of the Work.

1.3 QUALIFICATIONS

A. The Special Inspector and Testing/Inspecting Agency shall be accepted by the Owner.

B. Special Inspections shall be performed by agents who have relevant experience for each category of inspections indicated on the drawings.

C. Minimum qualifications of inspection agents are indicated on the drawings.

1.4 SUBMITTALS

A. The Special Inspector and Testing/Inspecting Agency shall submit to the Registered Design Professional and Code Enforcement Official for review, a copy of their qualifications including the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.

B. The Special Inspector and Testing/Inspecting Agency shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

1.5 PAYMENT

A. The Owner will engage and pay for the services of the Special Inspector and Testing/Inspecting Agency.

B. If any materials requiring Special Inspections are fabricated in a plant not located within 200 miles of the project site, the Contractor shall be responsible for the travel expenses of the Special Inspector or Testing/Inspecting Agency.

C. The Contractor shall be responsible for the cost of any retesting or re-inspection of work failing to comply with the requirements of the Contract Documents.

1.6 OWNER RESPONSIBILITIES

A. The Owner will provide the Special Inspector with a complete set of Contract Documents sealed by the Registered Design Professional and approved by the Code Enforcement Official.

1.7 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Special Inspector and his agents so that Special Inspections and testing may be performed without hindrance.

B. As indicated in the Schedule of Special Inspections, the Contractor shall notify the Special Inspector and/or Testing/Inspecting Agency at least 48 hours in advance of a required inspection or test.

C. The Contractor shall provide incidental labor and facilities to provide access to the Work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

D. If Special Inspections or testing require the use of the Contractor's scaffolding to access work areas, the Contractor shall provide a competent person to perform the daily evaluation of the scaffolding to verify that it is safe to use. The Contractor shall notify the Special Inspector and Testing Agent of this review before each use. The Contractor is responsible for the safe assembly and stability of the scaffolding.

E. The Contractor shall keep the latest set of Construction Drawings, field sketches, accepted shop drawings, and specifications at the project site for field use by the Inspectors and Testing Technicians.

F. The Contractor shall perform remedial work (if required) and sign non-conformance reports stating that remedial work has been completed. The Contractor shall submit signed reports to the Special Inspector as Work proceeds.

G. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.

H. The Contractor shall be solely responsible for construction site safety.

1.8 LIMITS ON AUTHORITY

A. The Special Inspector or Testing/Inspecting Agency shall not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Special Inspector or Testing/Inspecting Agency shall not have control over the Contractor's means and methods of construction.

C. The Special Inspector or Testing/Inspecting Agency shall not be responsible for construction site safety.

D. The Special Inspector or Testing/Inspecting Agency shall not have the authority to stop the Work.

2.0 INSPECTIONS AND TESTING

A. The Contractor shall follow the Special Inspection requirements developed by the Registered Design Professional of Record.

3.0 DOCUMENTATION

3.1 RECORDS AND REPORTS

A. Detailed reports shall be prepared of each test or inspection. The reports shall include the following general information:

1. Project name and number.
2. Date of test or inspection.
3. Name of Testing Agency or Inspecting Agency.
4. Name of technician or inspector.
5. Weather conditions.
6. Locations and elevations of specific areas tested or inspected referenced to gridlines.
7. Description of test or inspection.
8. Reference to applicable ASTM standard.
9. Summary of observations, results, and recommendations.
10. Description of any areas or materials requiring retesting or re-inspection.

B. Concrete compressive strength test reports shall contain the following information:

1. Name of Contractor and concrete supplier.
2. Name of concrete testing service.
3. Name of technician making and testing specimens.
4. Truck number and delivery ticket number.
5. Date and location within the structure of concrete placement.
6. Concrete type, class, mix proportions of materials, and design compressive strength at 28 days.
7. Slump, air content, unit weight, and concrete temperature.
8. Total time period between batching and completion of placement for each truck.
9. Compressive strength and type of break for all tests.

C. Field reports for concrete inspection shall contain the general information noted above, plus ambient temperature and cylinder numbers.

D. Test reports for masonry materials shall include proportions, composition, and compressive strength.

3.2 COMMUNICATION

A. The Testing/Inspecting Agency shall immediately notify the Owner, Contractor, Special Inspector, and Registered Design Professional by telephone or email of any test results failing to comply with the requirements of the Contract Documents.

B. The Special Inspector shall immediately notify the Contractor of any work found to be in nonconformance with the Contract Documents during inspections. If the nonconforming work is not corrected while the Special Inspector is on-site, the Special Inspector shall notify the Owner and Registered Design Professional within 24 hours (one business day) and issue a nonconformance report. The Special Inspector may use the Special Inspection Non-Conformance Report form at the end of this section or other similar form.

C. If the nonconforming work is not corrected at the time of substantial completion of the structure or other appropriate time, the Special Inspector shall notify the Owner.

3.3 DISTRIBUTION OF REPORTS

A. The Testing/Inspecting Agency shall submit reports to the Owner, Special Inspector and the Registered Design Professional within seven (7) days of the inspection or test. Reports may be submitted in the ePM system.

B. The Special Inspector shall submit reports to the Owner and Registered Design Professional within seven (7) days of the inspections. Reports may be submitted in the ePM system

C. If requested by the Code Enforcement Official, the Special Inspector shall submit interim reports which include all inspections and tests performed since the beginning of construction or since the previous interim report. Interim reports shall be addressed to the Code Enforcement Official with copies sent to the Registered Design Professionals (Structural Engineer and Architect) and Contractor. Interim reports shall be signed by the agent performing inspections.

3.4 FINAL REPORT OF SPECIAL INSPECTIONS

A. At the completion of Work, each Testing/Inspecting Agency shall electronically submit an Agent's Final Report of Special Inspections to the Special Inspector stating that work was completed in substantial conformance with the Contract Documents and that appropriate inspections and tests were performed. The Testing/Inspecting Agency may use the Agent's Final Report of Special Inspections form provided at the end of this section or other similar form.

B. At the completion of Work, the Special Inspector shall compile all inspection and test reports generated by each Agent into a Final Report of Special Inspections. The Final Report of Special Inspections shall state that required inspections have been performed and shall itemize any nonconforming work not corrected or resolved.

C. The Special Inspector may use the Final Report of Special Inspections form provided at the end of this section or other similar form based on CASE Form 102-2001.

D. The Special Inspector shall submit The Final Report of Special Inspections to the Owner, Registered Design Professional and Code Enforcement Official prior to issuance of a Certificate of Use and Occupancy.

SPECIAL INSPECTION NON-CONFORMANCE REPORT NO.

DATE: _____

TO:

CC: Contractor:

FROM: _____, Special Inspector

PROJECT:

PART I: REFERENCE SPECIAL INSPECTION REPORT NO. _____

(*Attach copy of report*)

DESCRIPTION OF NON-CONFORMANCE:

RDP RESPONSE: (PROVIDE ATTACHMENTS IF NECESSARY)

RDP SIGNATURE _____ DATE_____

IS RE-INSPECTION BY SPECIAL INSPECTOR REQUIRED □ YES □ NO

PART II: CONTRACTOR VERIFICATION (To be completed by either the ***[General Contractor or Construction Manager]*** or Subcontractor and returned to the Special Inspector and the RDP.)

I verify that as of the date listed, the non-conforming item noted above has been corrected as required.

Date Completed _____ By _____

(Contractor's Site Representative)

AGENT'S FINAL REPORT OF SPECIAL INSPECTIONS

Project Name: _____ Special Inspector: _____

Location: _____ Agent: _____

Special Inspector's Project: _____

Agent's Project: _____

To the best of my information, knowledge, and belief, the Special Inspections or testing required for this project and designated for this Agent in the Statement of Special Inspections (which includes the Schedule of Special Inspections) submitted for permit have been performed and discovered discrepancies have been reported and resolved other than the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Respectfully submitted,
Agent of the Special Inspector

_____
(Type or print name)

_____
Signature Date

_____
Address

_____
City, State, Zip

Design Professional Seal
or Certification

FINAL REPORT OF SPECIAL INSPECTIONS
AND STRUCTURAL OBSERVATIONS

Project Name: _____

Location: _____

Owner: CORNELL UNIVERSITY
Owner's Address:

Registered Design Professionals

Architecture: *Name*
Address

Structural Engineering: *Name*
Address

Special Inspector: *Name*
Address

To the best of my information, knowledge, and belief, the Special Inspections required for this project and itemized in the Statement of Special Inspections (which includes the Schedule of Special Inspections) submitted for permit have been performed and discovered discrepancies have been reported and resolved other than the following:

Comments:

[Attach continuation sheets if required to complete description of uncorrected discrepancies.]

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report. Agent's Final Reports of Special Inspections are attached and are also a part of this Final Report.

Respectfully submitted,

Special Inspector

_____
(Type or print name)

_____
Signature Date

Professional Seal

*****END OF SECTION 01 45 33*****

Schedule of Special Inspections

This Schedule of Special Inspections includes the following building systems:

- ☐ Special Cases
- ☒ Steel Construction
- ☐ Cold-Formed Steel Framing
- ☒ Concrete Construction
- ☒ Masonry Construction
- ☐ Wood Construction
- ☒ Soils and Foundations
- ☐ Architectural Components
- ☐ Mechanical & Electrical Components
- ☐ Storage Racks
- ☐ Spray Fire-Resistant Materials
- ☐ Mastic & Intumescent Fire-Resistant Coatings
- ☐ Exterior Insulation & Finish Systems
- ☒ Fire-Resistant Penetrations and Joints
- ☐ Smoke Control Systems
- ☐ Other

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. Special Inspector (Structural)	*To Be Determined*	
2. Special Inspector (Architectural)	*To Be Determined*	
3. Special Inspector (MEP)	*N/A*	
4. Special Inspector (Geotechnical)	*To Be Determined*	
5. Testing Agency	*To Be Determined*	
6. Testing Agency	*To Be Determined*	

Statement of Special Inspections

Project: *Renovation - Cornell Beebe Hall Maker Hub*

Location: *110 Arboretum Road, Ithaca, NY 14850*

Owner: *Cornell University*

Design Professional in Responsible Charge

Structural: *John P. Stopen Engineering, LLP*

Architectural: *Ashley McGraw Architects*

M/E/P: *Salas O'Brien*

Geotechnical: *John P. Stopen Engineering, LLP*

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspectors and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

- ☒ Structural
- ☐ Mechanical/Electrical/Plumbing (MEP)
- ☒ Architectural
- ☒ Geotechnical

The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Any discrepancies from the Contract Documents found during a Special Inspection shall be immediately reported to the Contractor. If the discrepancies are not corrected, the Special Inspector shall immediately notify the RDP and Building Official by telephone, email, or fax. Reports shall document all discrepancies identified and the corrective action taken. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

(**RDP Structural)**

Printed or Typed Name

Signature

Date

(RDP Geotechnical)

Printed or Typed Name

Signature

Date

(**RDP Architectural)**

Printed or Typed Name

Signature

N.A.

(RDP M/E/P)

Printed or Typed Name

Signature

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
1704.2.5 Inspection of Fabricators Verify fabrication/quality control procedures	In-plant review (1)	Y	Periodic	
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative materials and systems, unusual design applications, materials and systems with special manufacturer's requirements)	Submittal review, shop (1) and/or field inspection	N		
1705.2 Steel Construction				
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, chapter N, paragraph 3.2 for compliance with construction documents)	Submittal Review	Y	Each submittal	
2. Material verification of structural steel	Shop (1) and field inspection	Y	Periodic	
3. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Continuous	
4. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic	
5. Structural steel welding:				
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (1) and field inspection	Y	Observe or Perform as noted (2)	
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (1) and field inspection	Y	Observe (2)	
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (1) and field inspection	Y	Observe or Perform as noted (2)	
d. Nondestructive testing (NDT) of welded joints:				
1) Complete penetration groove welds 5/16" or greater in *risk category* III or IV	Shop (1) or field ultrasonic testing - 100%	N	Periodic	
2) Complete penetration groove welds 5/16" or greater in *risk category* II	Shop (1) or field ultrasonic testing - 10% of welds minimum	N	Periodic	
3) Thermally cut surfaces of access holes when material t > 2"	Shop (1) or field magnetic Particle or Penetrant testing	Y	Periodic	
4) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (1) or field radiographic or Ultrasonic testing	N	Periodic	
5) Fabricator's NDT reports when fabricator	Verify reports	Y	Each submittal (3)	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
performs NDT				
A6. Structural steel bolting:	Shop (1) and field inspection			
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360, Table N5.6-1)		Y	Observe or Perform as noted (2)	
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360, Table N5.6-2)		Y	Observe (4)	
1) Pre-tensioned and slip-critical joints				
a) Turn-of-nut with matching markings		Y	Periodic	
b) Direct tension indicator		Y	Periodic	
c) Twist-off type tension control bolt		Y	Periodic	
d) Turn-of-nut without matching markings		Y	Continuous	
e) Calibrated wrench		Y	Continuous	
2) Snug-tight joints		Y	Periodic	
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (2)	
7. Inspection of steel elements of composite construction prior to concrete placement in accordance with QA tasks listed in AISC 360, Table N5.6-1	Shop (1) and field inspection and testing	N	Observe or Perform as noted (2)	
1705.2.2 Steel Construction Other Than Structural Steel				
1. Material verification of cold-formed steel deck:				
a. Identification markings	Field inspection	N	Periodic	
b. Manufacturer's certified test reports	Submittal Review	N	Each submittal	
2. Connection of cold-formed steel deck to supporting structure:	Shop (1) and field inspection			
a. Welding		N	Periodic	
b. Other fasteners (in accordance with AISC 360, Section N5)		N		
1) Verify fasteners are in conformance with approved submittal		N	Periodic	
2) Verify fastener installation is in conformance with approved submittal and manufacturer's recommendations		N	Periodic	
3. Reinforcing steel	Shop (1) and field inspection			
a. Verification of weldability of steel other than ASTM A706		N	Periodic	
b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, boundary elements of special concrete structural walls and shear reinforcement		N	Continuous	
c. Shear reinforcement		N	Continuous	
d. Other reinforcing steel		N	Periodic	
4. Open-web steel joists and joist girders:				
a. End connections-welding or bolted		N	Periodic	
b. Standard bridging		N	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
MATERIAL / ACTIVITY	**SERVICE**	**APPLICABLE TO THIS PROJECT**		
		Y/N	**EXTENT**	**NOTES**
c. Bridging that differs from the SJI specifications listed in Section 2207.1		N	Periodic	
5.Cold-formed framing:				
a. Mechanical Connections: Sizes at locations of all fasteners.	Field inspection	Y	Periodic	
b. Welding: Shop at field welds inspected per AWS D.3	Shop (1) and field inspection	Y	Periodic	
6. Cold-formed steel trusses spanning 60 feet or greater				
a. Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic	
1705.3 Concrete Construction				
1. Inspection of reinforcing steel installation (see 1705.2.2 for welding)	Shop (1) and field inspection	Y	Periodic.	
2. Inspection of prestressing steel installation	Shop (1) and field inspection	N	Periodic	
3. Inspection of anchors cast in concrete where allowable loads have been increased per section 1908.5 or where strength design is used	Shop (1) and field inspection	N	Continuous	
4. Inspection of anchors and reinforcing steel post-installed in hardened concrete: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source	
5. Verify use of approved design mix	Shop (1) and field inspection	Y	Periodic	
6. Fresh concrete sampling, perform slump and air content tests and determine temperature of concrete	Shop (1) and field inspection	Y	Continuous	
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (1) and field inspection	Y	Continuous	
8. Inspection for maintenance of specified curing temperature and techniques	Shop (1) and field inspection	Y	Periodic	
9. Inspection of prestressed concrete:	Shop (1) and field inspection			
a. Application of prestressing force		N	Continuous	
b. Grouting of bonded prestressing tendons in the seismic-force- resisting system		N	Continuous	
10. Erection of precast concrete members				
a. Inspect in accordance with construction documents	Field inspection	N	In accordance with construction documents	
b. Perform inspections of welding and bolting in accordance with Section 1705.2	Field inspection	N	In accordance with Section 1705.2	
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	N	Periodic	
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	Y	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
MATERIAL / ACTIVITY	**SERVICE**	**APPLICABLE TO THIS PROJECT**		
		Y/N	**EXTENT**	**NOTES**
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic	
1705.4 Masonry Construction	See Section 3.1 of TMS 402-13 for Applicable Level of Quality Assurance			
(A) Level A Quality Assurance:				
1. Prior to construction, verify certificates of compliance used in masonry construction	Document Review	Y	Periodic	
(B) Level B Quality Assurance:				
1. Verification of Slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with Specification Article 1.5.B.1.b.3 for self-consolidating grout.	Field Testing	N	Continuous	
2. Verification of *f'm* and *f'm AAC* in accordance with Specification Article 1.4.B prior to construction, except where specifically exempted by this Code	Testing by unit strength or prism test method	Y	Periodic	
3. Verify compliance with the approved submittals	Field Inspection	Y	Periodic	
4. As masonry construction begins, verify that the following are in compliance:				
a. Portions of site-prepared mortar	Field Inspection	Y	Periodic	
b. Construction of mortar joints	Field Inspection	Y	Periodic	
c. Grade and size of prestressing tendons and anchorages	Field inspection	N	Periodic	
d. Location of reinforcement, connectors, and prestressing tendons and anchorages	Field Inspection	Y	Periodic	
e. Prestressing technique	Field Inspection	N	Periodic	
f. Properties of thin-bed mortar for AAC masonry	Field Inspection	N	Continuous (4) Periodic (5)	
5. Prior to grouting, verify that the following are in compliance				
a. Grout space	Field Inspection	Y	Periodic	
b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages	Field Inspection	Y	Periodic	
c. Placement of reinforcement, connectors, and prestressing tendons and anchorage	Field Inspection	Y	Periodic	
d. Portions of site-prepared grout and prestressing grout for bonded tendons	Field Inspection	N	Periodic	
e. Construction of mortar joints	Field Inspection	Y	Periodic	
6. Verify during construction:				
a. Size and location of structural elements	Field Inspection	Y	Periodic	
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	Field inspection	Y	Periodic	
c. Welding of reinforcement.	Field inspection	N	Continuous	
d. Preparation, construction, and protection of masonry during cold weather (temperature below 40 deg F (4.4 deg C)) or hot weather (temperature above 90 deg F	Field inspection	N	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
(32.2 deg C)).				
e. Application and measurement of prestressing force	Field Inspection	N	Continuous	
f. Placement. of grout and prestressing grout for bonded tendons is in compliance	Field inspection	N	Continuous	
g. Placement of AAC masonry units and construction of thin-bed mortar joints	Field inspection	Y	Continuous (4) Periodic (5)	
7. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	Y	Periodic	
(C) Level C Quality Assurance:				
1. Verification of proportions of *f'm* and *f''$_{AAC}$* in accordance with Specification Article 1.4.B prior to construction and for every 5,000 sq. ft. (465 sq. m) during construction.	Testing by unit strength	N	Periodic	
2. Verification of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout, as delivered to the project site.	Field Inspection	N	Continuous	
3. Verification of Slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with Specification Article 1.5.B.1.b.3 for self-consolidating grout	Field Testing	N	Continuous	
4. Verify compliance with the approved submittals.	Field Testing	N	Periodic	
5. Verify that the following are in compliance:				
a. Proportions of site-mixed mortar, grout and prestressing grout for bonded tendons	Field Inspection	N	Periodic	
b. Grade, type and size of reinforcement and anchor bolts, and prestressing tendons and anchorages	Field Inspection	N	Periodic	
c. Placement of masonry units and construction of mortar joints	Field Inspection	N	Periodic	
d. Placement of reinforcement, connectors and prestressing tendons and anchorages	Field Inspection	N	Continuous	
e. Grout space prior to grouting	Field Inspection	N	Continuous	
f. Placement of grout and prestressing grout for bonded tendons	Field Inspection	N	Continuous	
g. Size and locations of structural elements	Field Inspection	N	Periodic	
h. Type, size and location of anchors including other details of anchorage of masonry to structural members, frames or other construction	Field Inspection	N	Continuous	
i. Welding of reinforcement	Field Inspection	N	Continuous	
j. Preparation, construction, and protection of masonry during cold weather (temperature below 40 deg F (4.4 deg C)) or hot weather (temperature above 90 deg F (32.2 deg C))	Field Inspection	N	Periodic	
k. Application of measurement of prestressing force	Field Inspection	N	Continuous	
l. Placement of AAC masonry units and construction of thin-bed mortar joints	Field Inspection	N	Continuous	
m. Properties of thin-bed mortar for AAC masonry.	Field Inspection	N	Continuous	
6. Observe preparation of grout specimens, mortar specimen, and/or prisms	Field Inspection	N	Continuous	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
1705.5 Wood Construction				
1. Inspection of the fabrication process of wood structural elements and assemblies in accordance with Section 1704.2.5	In-plant review (1)	N	Periodic	
2. Diaphragms and shearwalls: verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection	N	Periodic	
3. Diaphragms and shearwalls: verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans. Installation of hold-down and tie-down systems.	Field inspection	N	Periodic	
4. Metal-plate-connected wood trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package.	Field inspection	N	Periodic	
5. Connections:				
a. Installation of metal framing anchors	Field inspection	N	Periodic	
b. Attachment of multi-ply members	Field inspection	N	Periodic	
c. Installation of connections specified	Field inspection	N	Periodic	
6. Framing and Details				
a. Verification of load bearing framing member size and	Field inspection	N	Periodic	
7. Load-bearing wall Panels site-built panels : all panels inspected Prefabricated panels: three panels per 1,000 linear feet of load-bearing wall panels inspected.				
a. Framing quality (wane, knots, splits, etc.)	Field inspection	N	Periodic	
b. Opening framing correctness (headers, sills, jamb members)	Field inspection	N	Periodic	
c. Correct stud spacing	Field inspection	N	Periodic	
d. Correct top/bottom plates	Field inspection	N	Periodic	
e. Sheathing attach: field/edge pattern/spacing correct	Field inspection	N	Periodic	
f. Presence of nail “shiners”	Field inspection	N	Periodic	
1705.6 Soils				
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic	
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic	
3. Perform classification and testing of controlled fill materials.	Field inspection	Y	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection	Y	Continuous	
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic	
1705.7 Driven Deep Foundations				
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	N	Continuous	
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous	
3. Observe driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous	
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous	
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2	
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3	
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with construction documents	
8. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents	
1705.8 Cast-in-Place Deep Foundations				
1.Observe drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous	
3. For concrete elements, perform additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3	
4. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents	
1705.9 Helical Pile Foundations				
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other data as required.	Field inspection	N	Continuous	
2. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
1705.11 Special Inspections For Wind Resistance				
1705.11.1 Structural Wood Special Inspections For Wind Resistance				
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous	
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system	Shop (1) and field inspection	N	Periodic	
1705.11.2 Cold-formed Steel Special Inspections For Wind Resistance				
1.Inspection during weldingoperations of elements of the main windforce-resisting system	Shop (1) and field inspection	N	Periodic	
2.Inspections for screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system	Shop (1) and field inspection	N	Periodic	
1705.11.3 Wind-resisting Components				
1. Roof cladding	Shop (1) and field inspection	N	Periodic	
2. Wall cladding	Shop (1) and field inspection	N	Periodic	
1705.12 Special Inspections for Seismic Resistance				
1705.12.1 Structural Steel Special Inspections for Seismic Resistance				
Inspection of structural steel in accordance with AISC 341	Shop (1) and field inspection	N	In accordance with AISC 341	
1705.12.2 Structural Wood Special Inspections for Seismic Resistance				
1. Inspection of field gluing operations of elements of the seismic- force resisting system	Field inspection	N	Continuous	
2. Inspection of nailing, bolting, anchoring and other fastening of components within the seismic-force- resisting system	Shop (1) and field inspection	N	Periodic	
1705.12.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance				
1. Inspection during welding operations of elements of the seismic- force-resisting system	Shop (1) and field inspection	N	Periodic	
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system	Shop (1) and field inspection	N	Periodic	
1705.12.4 Designated Seismic Systems Verification				
Inspect and verify that that the component label, anchorage or mounting conforms to the certificate of	Field inspection	N	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
compliance in accordance with Section 1705.12.3				
1705.12.5 Architectural Components Special Inspections for Seismic Resistance				
1. Inspection during the erection and fastening of exterior cladding and interior and exterior veneer	Field inspection	N	Periodic	
2. Inspection during the erection and fastening of interior and exterior nonbearing walls	Field inspection	N	Periodic	
3. Inspection during anchorage of access floors	Field inspection	N	Periodic	
1705.12.6 Mechanical and Electrical Components Special Inspections for Seismic Resistance				
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems. (SDC C,D,E,F)	Field inspection	N	Periodic	
2. Inspection during the anchorage of other electrical equipment. (SDC E,F)	Field inspection	N	Periodic	
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units (SDC C,D,E,F)	Field inspection	N	Periodic	
4. Inspection during the installation and anchorage of HVAC ductwork that will contain hazardous materials. (SDC C,D,E,F)	Field inspection	N	Periodic	
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the approved construction documents require a nominal clearance of 1/4 inch or less between the equipment support frame and restraint.	Field inspection	N	Periodic	
6. Installation of mechanical and electrical equipment including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to Seismic Design Category C, D. E or F to verify one of the following: See notes	Field inspection	N	Periodic	a. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7. b. A nominal clearance of not less than 3 inches has been provided between fire protection sprinkler system drops and sprigs and; structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and; other systems' piping. c. Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.
1705.12.7 Storage Racks Special Inspections for Seismic Resistance (SDC D,E,F)				
Inspection during the anchorage of storage racks 8 feet or greater in height	Field inspection	N	Periodic	
1705.12.8 Seismic Isolation Systems (SDC B,C,D,E,F)				
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system	Shop (1) and Field inspection Shop and field inspection	N	Periodic	
1705.12.9 Cold-Formed Steel Special Bolted Moment Frames				
Inspection for installation of cold-formed steel special bolted moment frame	Field Inspection	N	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
1705.13 Testing for Seismic Resistance				
1705.13.1 Structural Steel Testing and Qualification for Seismic Resistance				
Test in accordance with the quality assurance requirements of AISC 341	Shop (1) and field testing	N	Per AISC 341	
1705.13.4 Seismic Isolation Systems				
Test seismic isolation system in accordance with ASCE 7 Section17.8	Prototype testing	N	Per ASCE 7	
1705.14 Sprayed Fire-resistant Materials				
1. Verify surface condition preparation of structural members	Field inspection	N	Periodic	
3. Verify average thickness of sprayed fire-resistant materials applied to structural members	Field inspection	N	Periodic	
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing	N	Per IBC Section 1705.13.5	
5. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing	N	Per IBC Section 1705.13.6	
1705.15 Mastic and Intumescent Fire-Resistant Coatings				
Inspect mastic and intumescent fire- resistant coatings applied to structural elements and decks	Field inspection	N	Periodic	
1705.16 Exterior Insulation and Finish Systems (EIFS)				
1. Verify materials, details and installations are per the approved construction documents	Field inspection	N	Periodic	
2. Inspection of water-resistive barrier over sheathing substrate	Field inspection	N	Periodic	
1705.17 Fire-Resistant Penetrations and Joints				
1. Inspect penetration firestop systems	Field testing	Y	Per ASTM E2174	
2. Inspect fire-resistant joint systems	Field testing	Y	Per ASTM E2393	
1705.18 Smoke Control Systems				
1. Leakage testing and recording of device locations prior to concealment	Field testing	N	Periodic	

SCHEDULE OF SPECIAL INSPECTION SERVICES				
Per IBC Section 1704 of the 2024 International Building Code the following items require Special Inspections. Additional Special Inspection items may have been added by the Registered Design Professional.				
PROJECT: Renovation - Cornell Beebe Hall Maker Hub		**OWNER: Cornell University**		
		APPLICABLE TO THIS PROJECT		
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**NOTES**
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing	N	Periodic	

Notes:

1. Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1
2. Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.
3 NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360 N7.
4. Required for the first 5,000 sq. ft. of AAC masonry.
5. Required after the first 5,000 sq. ft of AAC masonry.

Final Report of Special Inspections - Structural

Project: *Renovation - Cornell Beebe Hall Maker Hub*

Location: *110 Arboretum Road, Ithaca, NY 14850*

Owner: *Cornell University*

Structural Engineer of Record: *John P. Stopen Engineering, LLP*

To the best of my information, knowledge and belief, the Special Inspections required for this project, and itemized in the Statement of Special Inspections submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of discrepancies)

Interim reports submitted prior to this Final Report form a basis for and are an integral part of this Final Report.

Respectfully submitted,
Special Inspector

(Type or print name)

(Signature) (Date) Licensed Professional Seal

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Final Report of Special Inspections - Architectural

Project: *Renovation - Cornell Beebe Hall Maker Hub*

Location: *110 Arboretum Road, Ithaca, NY 14850*

Owner: *Cornell University*

Architect of Record: *Ashley McGraw Architects*

To the best of my information, knowledge and belief, the Special Inspections required for this project, and itemized in the Statement of Special Inspections submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of discrepancies)

Interim reports submitted prior to this Final Report form a basis for and are an integral part of this Final Report.

Respectfully submitted,
Special Inspector

(Type or print name)

(Signature) (Date) Licensed Professional Seal

Final Report of Special Inspections - Geotechnical

Project: *Renovation - Cornell Beebe Hall Maker Hub*

Location: *110 Arboretum Road, Ithaca, NY 14850*

Owner: *Cornell University*

Geotechnical Engineer of Record: *John P. Stopen Engineering, LLP*

To the best of my information, knowledge and belief, the Special Inspections required for this project, and itemized in the Statement of Special Inspections submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

(Attach continuation sheets if required to complete the description of discrepancies)

Interim reports submitted prior to this Final Report form a basis for and are an integral part of this Final Report.

Respectfully submitted,
Special Inspector

(Type or print name)

(Signature) (Date) Licensed Professional Seal

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Certificate of Compliance

Fabrication of Structural Load-Bearing or Lateral Load-resisting Members

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Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per Section 1904.2.5.1 of the 2025 BCNYS must submit a Certificate of Compliance at the completion of fabrication.

Project: _____

Fabricator's Name: _____

Certification or Approval Agency: _____

Certification Number: _____

Date of Last Audit or Approval: _____

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved Construction Documents.

_____ _____
Signature Date

_____
Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

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.

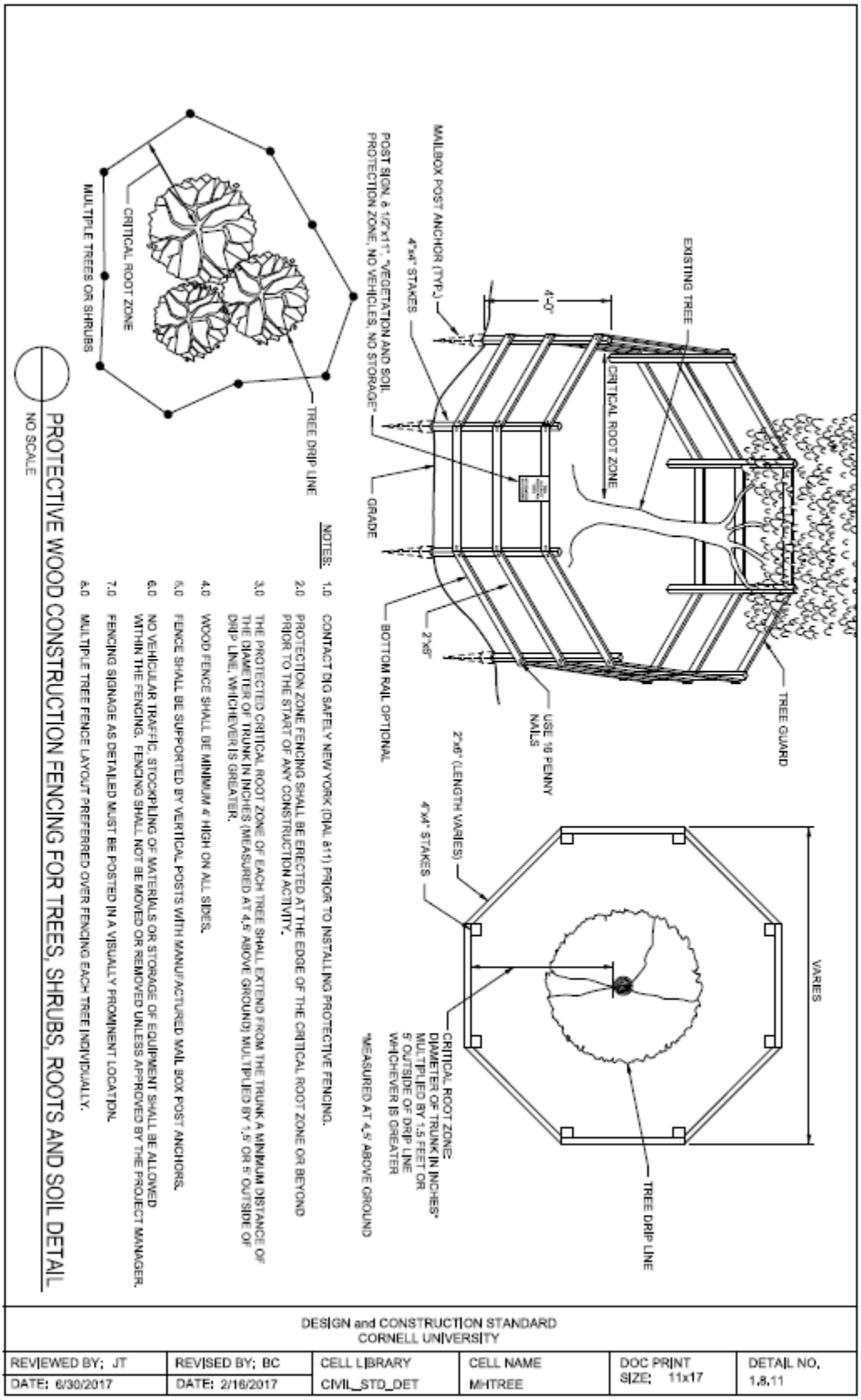
E. Carefully supervise excavating, grading and filling, and subsequent construction operations to prevent damage.

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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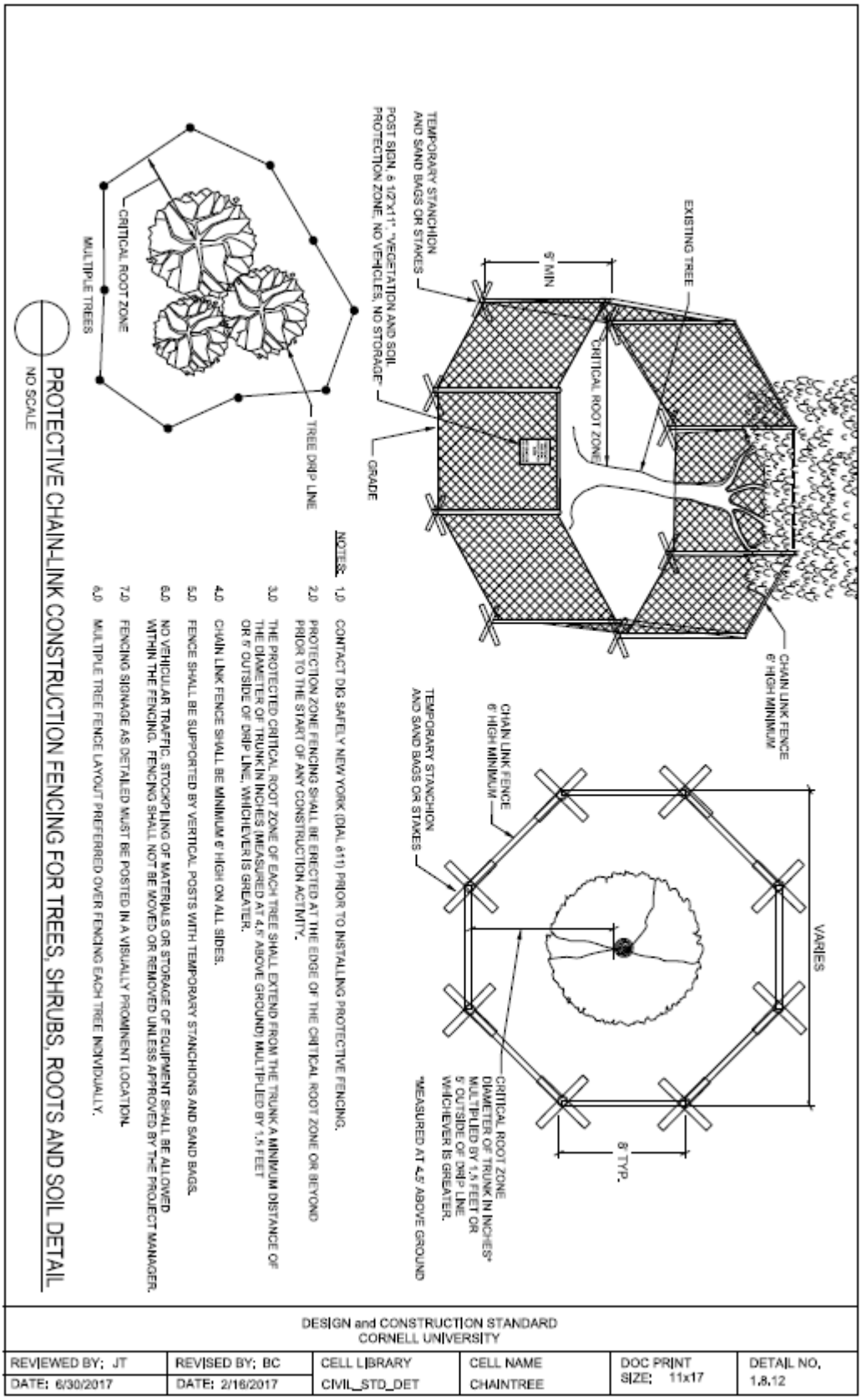

NOTES:

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.

PROTECTIVE CHAIN-LINK CONSTRUCTION FENCING FOR TREES, SHRUBS, ROOTS AND SOIL DETAIL

NO SCALE

DESIGN and CONSTRUCTION STANDARD
CORNELL UNIVERSITY

REVIEWED BY: JT	REVISED BY: BC	CELL LIBRARY	CELL NAME	DOC PRINT SIZE: 11x17	DETAIL NO. 1,8,12
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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. 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.

F. 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.

G. 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. Temporary Use of Permanent Elevator as Equipment and Material Hoists

1. The Contractor shall:

a. Use any temporary hoists until a building is completed, or until the Contractor may, with the Owner's permission, use the equipment of one (1) elevator in a building for temporary service after the permanent elevator equipment and the permanent electric service have been installed.

b. If the Contractor elects to use such permanent elevator equipment, the Contractor shall:

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

- Provide for the maintenance of the elevator equipment as approved by the Owner's Representative.

- 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.

2. The permanent elevator equipment shall be ready for use when required by the Work and the Contractor shall permit any use approved by the Owner or the Owner's Representative.

3. When using permanent building elevator for temporary hoisting of equipment and materials, provide a written maintenance plan for acceptance by the Owner's Representative, prior to utilizing the equipment. Return all equipment to its newly installed condition prior to acceptance testing. The warranty period for such equipment shall not commence until the Owner's final acceptance of the facility.

B. Temporary Elevator Service for Workers

1. General

a. The Contractor may provide necessary temporary elevator service for workers and all others engaged on the Work until the permanent elevators are completed and in use.

b. When the permanent elevators are completed, the Contractor shall operate and shall maintain one (1) of the permanent elevator installations for the transportation of workers and all other persons engaged in the Work. Temporary elevator equipment may be removed when permanent elevator equipment is available to the Contractor.

c. The Contractor shall include in the bid price the cost of temporary elevator facilities, if they are necessary.

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. Provide adequate toilet and washing facilities for the use of personnel and employees; locate convenient to work stations.

B. Existing plumbing facilities shall not be used by construction personnel.

C. Facilities may be portable chemical-type toilets or temporary flush toilets connected to sanitary sewer, screened for privacy.

D. Service, clean and maintain facilities and enclosures in a neat, clean and sanitary condition.

3.0 EXECUTION

3.1 REMOVAL

A. Completely remove temporary materials and equipment when their use is no longer required.

B. Clean and repair damage caused by temporary installations or use of temporary facilities.

C. Restore existing and permanent facilities used for temporary services to specified, or to original, condition.

*****END OF SECTION 01 51 00*****

SECTION 01 51 23 HEAT DURING CONSTRUCTION

1.0 GENERAL

1.1 DESCRIPTION

A. 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 57 13 SOIL EROSION AND SEDIMENT CONTROL

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall be responsible for preparing and implementing an Erosion and Sediment Control Plan.

B. This Section describes minimum standards for the prevention and control of erosion during the construction process and may not be sufficient for all sites. The Contractor shall remain responsible for the means and methods of preventing erosion and may be required to employ additional means and methods as required to prevent violations of local, state, or federal standards.

C. Contractor shall be responsible for regulatory fines and/or delays resulting from Contractor's failure to adhere to the plan or correct deficiencies identified during inspections.

1.2 SUBMITTALS

A. Submit an Erosion and Sediment Control Plan, as specified herein.

B. Refer to Section 01 33 00 – Submittal Procedures.

1.3 PLAN AND IMPLEMENTATION GENERAL REQUIREMENTS

A. Plan shall comply with design specifications in the New York Guidelines for Urban Erosion and Sediment Control, NYS Stormwater Management Design Manual, NYSDEC Technical and Operational Guidance Series, local storm water codes, good engineering practices, and this Section.

B. Erosion and Sediment Control Plan shall be reviewed and approved by the Environment, Health and Safety Office, and implemented prior to any site work. Contact information for EHS can be found at: https://ehs.cornell.edu/about-us/contact-us

C. Maintain Erosion and Sediment Control measures throughout the course of site construction activities until vegetative growth is established to the Owner's satisfaction.

D. At conclusion of the Project, remove all remaining temporary erosion control structures and properly dispose of accumulated sediment on-site in areas approved by the Owner.

1.4 PERFORMANCE STANDARDS

A. At no time shall construction operations or any related disturbance of the site result in the impairment of local waterways. "Impairment" is defined by regulations as including, but not limited to, the following:

1. The release of water into receiving waters that causes a substantial visible contrast to natural conditions; or

2. The deposition of significant sediment into such waters.

B. Such deficiencies shall be corrected immediately by the Contractor to prevent further impairment.

C. In addition, and without notice to the Contractor, the Owner shall also have the right, based on the Owner's independent assessment, to stop work or engage other contractor(s) to construct or correct such work as may be necessary to prevent the impairment of waterways, and to charge all costs related to such corrective or additional actions against the Contract.

D. Acceptance of an Erosion and Sediment Control plan shall not in any way imply that the plan will be adequate in preventing impairment of waters, or that maintenance and modification will not be necessary. Rather, acceptance of the plan authorizes the Contractor to begin installation of the control measures under the assumption the appropriate maintenance and modification will be required throughout the life of the project to meet the project requirements.

E. The Contractor's responsibilities under this Section shall end upon final completion and payment of the Work of the entire Contract.

1.5 EROSION AND SEDIMENT CONTROL PLAN COMPONENTS

A. The Erosion and Sediment Control Plan submitted shall specifically address project measures, features, and areas critical to proper site erosion and sediment control. The Plan shall specifically include, but are not limited to, the following:

1. Site Map, to scale;

2. Measures to prevent stormwater from running onto the disturbed areas of the site;

3. Inlet protection for storm sewers and catch basins;

4. Measures to be used for dewatering; and

5. Measures to be used for soil stabilization, runoff control, and sediment control, including specific measures for the following:

a. Site entrance stabilization

b. Staging areas

c. Material and soil stock piles

d. Concrete curing operations

e. Disturbed areas of the site

In addition to the requirements included in these specifications, specific erosion control measures shown on the Contract Drawings, if any, shall also be required.

B. All features shall be designed and installed in accordance with the references included in Paragraph 1.3 – Plan and Implementation General Requirements of this Section.

C. Keep access roads and public roads clear of mud and construction debris at all times. Maintain dust control measures throughout construction.

1.6 INSPECTIONS

A. At the sole discretion of the Owner, inspections may be performed by a third party or on-staff representative of the Owner.

1. The Owner may inspect the site at any time, without prior notification, for compliance with the Erosion and Sediment Control Plan and applicable local, state and federal regulations. Any instances of non-compliance or failure to meet the performance standards found must be resolved within 24 hours, with more immediate responses as required to mitigate active erosion during storm events or similar instances.

2. Modify the Erosion and Sediment Control Plan as necessary, to provide full compliance with the performance standards.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 57 13*****

SECTION 01 66 00 STORAGE AND PROTECTION

1.0 GENERAL

1.1 DESCRIPTION

A. Receive, pile, store and handle all materials, equipment and other items incorporated or to be incorporated in the Work, including items furnished by the Owner in a careful and prudent manner and shall protect them against loss or damage from every source.

B. Obscure from public view, in a manner acceptable to the Owner, staging and storage areas.

1.2 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions; using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction space.

C. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

D. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installation.

E. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.

F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

1.3 ON-SITE STORAGE

A. Materials stored on the Site shall be neatly piled and protected and shall be stored in a neat and orderly manner in locations that shall not interfere with the progress of the Work or with the daily functioning of the Institution.

B. Materials subject to weather damage shall be protected against the weather by floored weatherproof temporary storage sheds.

C. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

D. Storage piles and sheds shall be located within the area designated as the Staging Area. The Contractor shall work to ensure that the condition of the staging area has no negative impact on the Campus, visually or otherwise; and that outside of that area. The Contractor has no impact at all on the Campus.

E. Materials stored within the building shall be distributed in such a manner as to avoid overloading of the structural frame, and never shall be concentrated in such a manner as to exceed the equivalent of 50 pounds per square foot uniformly distributed loading. Stored materials shall be moved if they interfere with the progress of the Work.

F. Should it become necessary during the course of the Work to move stored materials or equipment, the Contractor, at the direction of the Owner or the Owner's Representative, shall move such materials or equipment.

1.4 CAMPUS SITE / BOOKBANK DRIVE STORAGE

A. All property including construction materials and equipment stored at the Bookbank Drive or other Campus site, shall be stored at the Contractor's sole risk. The Contractor is solely responsible for repair or replacement of property due to any cause of loss. Due to work at the Bookbank Drive lot, staging space is limited and not guaranteed to be provided. If staging space is needed, a request should be submitted to the Project Manager.

B. The Contractor agrees to hold Cornell harmless from any accident or injury occurring at Bookbank Drive storage or other assigned Campus site associated with the Contractor's storage.

C. The Contractor understands that Cornell makes "no" warranty regarding any security at the Bookbank Drive or other assigned Campus site.

D. The Contractor agrees that it is solely responsible for any cleanup of any site contamination caused by the Contractor's storage or storage operations and the Contractor agrees to pay for cleanup of any contamination and restore the site back to the same condition it was found.

E. It shall be assumed that the Contractor is responsible for site contamination unless the Contractor has reported condition prior to moving storage materials and equipment onto the site. Each Contractor shall be responsible for their own general area whether defined formally or not but in cases where pollutants have traveled or are found in the public areas used by all contractors, the Contractor agrees as follows:

1. If it cannot be determined who is responsible for site contamination after an investigation, all contractors who could be responsible based upon location of the incident agree to share the expense of cleanup equally.

F. No storage of hazardous materials or environmental contaminants is permitted at the Bookbank Drive or any Campus site. All barrels must have labels affixed identifying contents.

G. The Contractor will be responsible for securing and maintaining any Campus site area designated to them. All contractor trailers or storage containers located on Cornell Campus Property will need to file for a building permit with the Town of Ithaca. If the trailer/container is there longer than 180 days, the trailer/container will need to meet the Building Code requirements of a permanent structure. The trailer/container will need a means of egress that can be operated from the inside and a fire extinguisher. The contractor will also need to file for a demolition permit when the trailer/container is removed

H. Unoccupied storage containers not within the project fence shall be labeled in the Cornell standard.

1.5 PROTECTION

A. The Contractor shall provide security personnel and adopt other security measures as may be necessary to adequately protect materials and equipment stored at the site. The Contractor shall be obligated to replace or pay for all materials and equipment including items furnished by the Owner which have been damaged or stolen prior to completion of the Work.

B. Protection of Utilities

1. If during the course of the Project, it is necessary to work adjacent to existing utilities, pipelines, structures and equipment, the Contractor shall take all necessary precautions to protect existing facilities from damage.

2. Locations of utilities as shown on the Contract Documents are approximate only. The Contractor shall excavate or otherwise locate to verify existing utilities in advance of its operation.

C. Protective Covering

1. All finished surfaces shall be protected by the Contractor as follows:

a. Door and windowsills and the jambs and soffits of openings used as passageways or through which material is handled, shall be cased and protected adequately against possible damage resulting from the conduct of the work of all trades.

b. All surfaces shall be clean and not marred upon delivery of the building to the Owner. The Contractor shall, without extra compensation, replace all blocks, gypsum board, plaster, paint, tile, and all other surfaces, whether or not protected, which are damaged, and shall refinish (including painting as specified) to satisfaction of Owner.

c. Tight wood sheathing shall be laid under any materials that are stored on finished concrete surfaces and planking must be laid before moving any materials over these finished areas. Wheelbarrows used over such areas shall have rubber tires on wheels.

d. Contractor has the responsibility for protection of carpeting and all finish flooring during all phases of the Work including after installation.

e. All floors exposed to view as a floor finish shall be protected by overlaying with plywood in all areas subject to construction traffic within and without the building, special care shall be taken to protect all stair finish surfaces including but not limited to flooring, wood in-fill stairs, cabinetry, counters, equipment, etc.

2. HVAC ductwork shall be protected by the Contractor as follows to prevent introduction of contaminants:

a. Ductwork shall be wrapped at the factory using plastic wrap to exclude moisture and contaminants. The wrapping shall not be removed until immediately prior to installation.

b. Ductwork shall not be exposed to moisture or contaminants at any point in the manufacturing, shipping, storage or installation process.

c. Ductwork shall not be staged or stored outside or otherwise exposed to the weather.

d. Ductwork shall be transported only inside of covered vehicles.

e. Once installed, ductwork shall be protected from contamination during the construction process.

1.6 PROTECTION AFTER INSTALLATION

A. Protect installed products, including Owner-provided products, and control traffic in immediate area to prevent damage from subsequent operations.

B. Provide protective coverings at walls, projections, corners, and jambs, sills, and soffits of openings in and adjacent to traffic areas.

C. Cover walls and floors of elevator cabins, and jambs of cab doors, when elevators are used by construction personnel.

D. Protect finish floors and stairs from dirt, wear, and damage:

1. Secure heavy sheet goods or similar protective materials in place, in areas subject to foot traffic.

2. Lay planking or similar rigid materials in place, in areas subject to movement of heavy objects.

3. Lay planking or similar rigid materials in place, in areas where storage of products will occur.

E. Protect waterproofed and roofed surfaces:

1. Restrict use of surfaces for traffic of any kind, and for storage of products.

2. When an activity is mandatory, obtain recommendations for protection of surfaces from manufacturer. Install protection and remove on completion of activity. Restrict use of adjacent unprotected areas.

F. Restrict traffic of any kind across planted lawn and landscape areas.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 66 00*****

SECTION 01 71 23 FIELD ENGINEERING

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide and pay for field engineering services required for the Project.

1. Survey work required in execution of the Project.

2. Verify grades, lines, levels and dimensions shown on Drawings.

3. Lay out work from established control points and benchmarks.

4. Coordinate the work of all trades.

5. It may be necessary at times to discontinue portions of Contractor's work in order that the Owner's Representative may check measurements or surveys without interruptions or other interferences that might impair the accuracy of the results. At any time, on request of the Owner's Representative, Contractor shall discontinue its work to such extent as may be necessary for this purpose and shall cooperate in all reasonable means to the extent of providing labor, tools, or materials to assist the Owner's Representative in making measurements and surveys.

6. Notwithstanding anything set forth above, it shall be the sole responsibility of the Contractor to complete the Work within the tolerances of lines and grades as given on the drawings. No direct payment or claim for additional compensation will be allowed the Contractor for any work or delay occasioned by the Owner's Representative establishing or checking lines or grades or making other measurements, and no extension of time will be allowed for such delays.

B. Owner's Representative will identify existing control points and property line corner stakes indicated on the drawings, as required.

1.2 QUALIFICATION OF SURVEYOR

A. The Surveyor shall be a registered civil engineer or registered land surveyor, licensed in the state in which the Project is located and acceptable to the Owner.

1.3 SURVEY REFERENCE POINTS

A. Basic horizontal and vertical control points for the Project are those designated on drawings.

B. Locate and protect control points prior to occupation of the site, and preserve all reference points during construction.

1. Make no changes or relocations without prior written approval of the Architect and Owner.

2. Report to Owner when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3. Require surveyor to replace reference points which may be lost or destroyed.

a. Establish replacements based on original survey control.

C. The Contractor shall provide and shall maintain axis lines on each floor and shall establish and shall maintain grade marks 4' 0" above the finished floor on each floor level.

D. The Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the Work.

1.4 PROJECT SURVEY REQUIREMENTS

A. Prior to start of construction operations, review and verify figures shown on Drawings and on surveys furnished by Owner.

B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means for site improvements, stakes for grading, fill and topsoil replacement, utility slopes and invert elevations, batter boards for structures, foundations, column locations and floor levels, and controlling lines and levels required for the mechanical and electrical trades.

C. From time to time, verify layouts by the same methods.

1.5 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

1. Make available to Architect and Owner on request: field books, notes, logs and other data developed in performing survey and control work.

2. Maintain a record plan at field office for the information and use of all parties, recording reference points, control points and benchmarks.

B. On completion of foundations and major site improvements, prepare a certified survey showing all dimensions, locations, angles and elevations of construction and turn over to Owner. Submit copies of certified survey in accordance with Section 01 78 39 - Record Documents.

C. When all enclosing walls are complete, certify the location and plumb of the walls.

1.6 SUBMITTALS

A. Submit written qualifications of surveyor to Architect and Owner prior to starting survey work.

B. Submit name and address of Professional Engineer to the Architect.

C. Provide final survey of completed site construction to verify conformance design. Submit documentation to verify accuracy of field engineering work. Incorporate final survey with as-built drawings.

D. Submit certificate signed by registered engineer or registered surveyor certifying that elevations and improvements are in conformance, or nonconformance, with Contract Documents.

1. Indicate on record drawings all variations from Contract Drawings.

2. Indicate horizontal locations and elevations of all existing underground utilities encountered during excavation and construction.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 71 23*****

SECTION 01 73 29 CUTTING, PATCHING AND REPAIRING

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the Work or to:

1. Make sure several parts fit together properly.

2. Uncover portions of the Work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to requirements of Contract Documents.

5. Remove samples of installed work as specified for testing.

6. Repair or restore existing or new surfaces and finishes to match adjacent existing or new surfaces and finishes.

B. Upon written instructions of the Owner's Representative:

1. Uncover designated portions of Work for Architect's observation of covered work.

2. Remove samples of installed materials for testing beyond that specified.

3. Remove Work to provide for the alteration of previously incorrectly installed work.

4. Patch work uncovered or removed.

C. Do not damage or endanger any Work by cutting or altering the Work or any part thereof.

D. Do not cut or otherwise alter the Work of the Owner except with the written consent of the Owner's Representative.

E. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

F. Openings and Chases

1. Build openings, including but not limited to channels, chases and flues as required to complete the Work as set forth in the Contract.

2. After installation and completion of any work for which openings have been provided, build in, over, and around and finish all such openings as required to complete the Work.

3. Furnish and install all sleeves, inserts, hangers and supports required for the execution of the Work.

1.2 SUBMITTALS

A. Submit a written request to the Architect prior to executing any cutting, alteration or excavation which affects the Work of the Owner, or which may affect the structural safety of any portion of the Project. Include:

1. Identification of the Project.

2. Description of the affected Work.

3. The necessity for doing the cutting, alteration or excavation.

4. The effect on the Work of the Owner's property, or on the structural integrity of the Project.

5. Description of the proposed Work:

a. The scope of cutting, patching, alteration, or excavation.

b. Contractor and trades who will execute the work.

c. Products proposed to be used.

d. The extent of refinishing to be done.

6. Alternatives to cutting, patching or excavation.

7. Designation of the responsibility for the cost of cutting and patching.

8. Written permission of any separate contractor whose work will be affected.

B. Should conditions of the Work or the schedule indicate a change of products from the original installation, submit a request for substitution as specified in Section 01 25 00 - Substitutions and Product Options.

C. Submit a written notice to the Architect and the Owner designating the date and the time the Work will be uncovered.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity for load-deflection ratio.

1. Obtain written approval of the cutting and patching proposal before cutting and patching structural elements, including but not limited to the following:

a. Foundation construction

b. Bearing and retaining walls

c. Structural concrete

d. Structural steel and lintels

e. Structural decking

f. Miscellaneous structural metals

g. Exterior wall back-up supports and anchoring systems

h. Piping, ductwork, vessels, and equipment supports

i. Equipment supports

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operation life or safety.

1. Obtain written approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment

b. Air or smoke barriers

c. Water, moisture, or vapor barriers

d. Membranes and flashings

e. Fire protection systems

f. Control systems

g. Communication systems

h. Electrical wiring systems

i. Operating systems of special construction for MEP work

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Owner's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner at no expense to the Owner.

D. Waterproofing and Water Tightness: Do not cut or alter waterproofed walls or floors or any structural members without written permission of the Owner.

1. Waterproofing and Roofing Membranes

a. Employ qualified contractors to accomplish all required cutting, patching, or repairing of existing waterproofing and roofing membranes.

b. Before beginning cutting, patching or repairing of existing waterproofing and roofing membranes, obtain approval of all materials, methods and contractor to be used from the Owner and agency, or agencies, holding bond or guarantee/warranty in force for membrane.

2. Water Tightness

a. The Contractor shall be responsible for water tightness of product, materials, and workmanship, including work specified to be watertight and inferred by general practice to be watertight.

b. All floors (slabs), walls, roof, glazing, windows, doors, sleeves through foundation walls, flashings, and similar items shall be watertight.

c. If details or materials shown or specified are felt not satisfactory to produce water tightness, the Contractor shall inform the Owner's Representative before installation and submit proposed substitution or alternative method for review and approval. The Contractor shall execute approved change and make watertight at no additional cost to the Owner.

1.4 WARRANTIES

A. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

2.0 PRODUCTS

2.1 MATERIALS

A. Comply with the Contract Documents for each product involved.

B. Use materials identical to in-place or existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or surpass that of in-place or existing materials, and will match visual appearance of in-place or existing materials.

3.0 EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of the Project, including elements subject to damage or to movement during:

1. Cutting and patching.

2. Excavation and backfilling.

B. After uncovering Work, inspect the conditions affecting the installation of products, or performance of the Work.

C. Report unsatisfactory or dubious conditions to the Architect in writing; do not proceed with the Work until the Architect has provided further instructions.

3.2 PREPARATION

A. Provide shoring, bracing and other support as necessary to assure the structural safety of that portion of the Work.

B. Provide devices and methods to protect other portions of the Project from damage.

C. Provide for vertical and lateral support required to protect adjacent buildings and properties.

D. Provide protection from the elements for that portion of the Project which may be exposed by cutting and patching work, including but not limited to pumping to maintain excavations free from water.

E. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods which will assure safety, will be least likely to damage elements retained or adjoining construction, and will provide proper surfaces to receive new work.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carbon saw or a diamond-core drill.

4. Comply with the requirements of applicable MEP work where cutting and patching of services is required.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

3. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

    a. For continuous surfaces, refinish to nearest intersection.

    b. For an assembly, refinish the entire unit.

4. When patching existing plaster finished walls and partitions, the Contractor shall utilize plaster trim, lath and other metal components to match the integrity of the existing system. All plaster finishes shall match existing finishes so as to provide a uniform visual appearance.

5. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

6. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

7. Concrete Masonry Units: Patch walls by toothing-in units using salvaged or new CMU units matching in-place units for type and size. Match coursing patterns, mortar joint profiles, and other features of in-place CMU walls. Use accessory materials compatible with in-place materials.

8. Brick and Masonry: Patch walls by toothing-in units using salvaged or new brick and masonry matching in-place brick and masonry units. Match coursing patterns, mortar joint profiles, and other features of in-place brick and masonry walls. Use accessory materials compatible with in-place materials.

9. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

    a. Existing Roofing: Comply with requirements of existing roofing manufacturer for cutting and patching existing roofing system. Provide flashing and trim, base sheets, base flashing, adhesives, insulation, blocking, substrate boards, accessories, and other required items to patch roofing at penetrations and roof-top mounted items.

D. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

E. Execute excavating and backfilling by methods which will assure safety, will prevent settlement or damage to other work.

F. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

G. Restore Work which has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.

H. The Contractor shall replace, repair and patch all surfaces of the ground, and of any structure disturbed by its operations and its Work, which surfaces and structures are intended to remain, even if such operations and work are outside the property lines. Such replacement, repair and patching shall be with like material and shall restore surfaces as they existed.

3.4 CLEANING

A. Clean area and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

*****END OF SECTION 01 73 29*****

SECTION 01 77 00 PROJECT CLOSEOUT

1.0 GENERAL

1.1 INSPECTIONS

A. Substantial Completion:

1. Within a minimum of five (5) days prior to substantial completion, when the Work has reached such a point of completion that the building or buildings, equipment and apparatus can be occupied and used for the purpose intended, the Contractor shall conduct a detailed inspection of the Work to ensure that all requirements of the Contract have been met and that the Work is complete and is acceptable. Contractor shall prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

2. After receipt of the Contractor's initial punch list, the Architect will make an inspection of the Work to determine that the Work is substantially complete and that requirements of the Contract have been met and that the Work is sufficiently complete and is acceptable for use. The Architect will submit a marked-up list of items to be completed and/or corrected, inclusive of the Contractor's punch list, with an estimated dollar value for each item.

3. The Architect shall prepare a Certificate of Substantial Completion, template provided by the Owner, on the basis of an inspection, when the Architect has determined that the Work is substantially complete.

4. A copy of the report of the inspection will be furnished to the Contractor as the inspection progresses so that the Contractor may proceed without delay with any part of the Work found to be incomplete or defective.

5. All work performed under a Fire Protection System Installation/Alteration Operating Permit shall be inspected by the Ithaca Fire Department, or if so delegated by the Ithaca Building Department and the Owner's Environmental Health and Safety Department.

    a. A member of the Ithaca Fire Department shall witness all acceptance or reacceptance testing of work performed under a Fire Protection System Installation Operating Permit. All testing and inspections shall be in compliance with the applicable NFPA codes as referenced by Section 906.1 of the Fire Code of NYS.

    b. Work classified as a 'Repair' under the Existing Building Code does not require the Ithaca Fire Department to witness the testing of the affected systems. Systems that have been repaired must still be tested as required by the Fire Code of NYS and NFPA.

c. The Ithaca Fire Department Shall Witness the Acceptance or Reacceptance Testing for the Following Conditions:

- Testing of any new installation of a fire alarm, fire suppression, or fire detection system as required by the Fire Code of New York State.
- Hydrostatic testing of sprinkler system where the modification affects more than twenty (20) sprinkler heads and the modified area can be isolated from the rest of the system
- Installation or replacement of a fire pump or drive elements of the fire pump.
- A Fire Alarm System with added or deleted components.
- A Fire Alarm System where the wiring or control circuits have been modified.
- A Fire Alarm System where the control unit (Fire Alarm Panel) has been replaced or the control unit software has been replaced.
- A smoke control system where the master control unit, individual fan control unit, or fan drive unit has been replaced or modified.
- An alternative fire suppression system that has been replaced or the actuation elements have been modified. Except: fusible link replacement.
- A modification or extension of the piping fur a fire standpipe system where a hydrostatic test is required by NFPA 14.

B. Final Acceptance:

1. When the items appearing on the report of inspection have been completed or corrected, the Contractor shall so advise the Architect. After receipt of this notification and Contractor’s certified list of completed items, the Owner's Representative will inform the Contractor of the date and time of final inspection. A copy of the report of the final inspection containing all remaining contract exceptions, omissions and incomplete Work will be furnished to the Contractor.

2. After receipt of notification of completion and all remaining contract exceptions, omissions and incomplete Work from the Contractor, the Architect will make an inspection to verify completion of the exception items appearing on the report of final inspection.

1.2 SUBMITTALS

A. Contractor's List of Incomplete Items: Initial punch list submittal at Substantial Completion.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listing by room or space number. Organize items applying to each space by major element, including categories for individual exterior face elevations, ceilings, individual walls, floors, doors, roof levels, casework, equipment, and building systems.

B. Contractor's Certified List of Completed Items: Final signed punch list submittal at Final Completion.

C. Certificates of Release: Occupancy permits from authorities having jurisdiction.

1.3 FINAL CLEAN UP

A. Upon completion of the Work covered by the Contract the Contractor shall leave the completed Project ready for use and occupancy without the need of further cleaning of any kind and with all Work in new condition and in perfect order. In addition, upon completion of all Work, the Contractor shall remove from the vicinity of the Work all plant, buildings, rubbish, unused materials, concrete forms and other materials belonging to him or used under its direction during construction or impairing the use or appearance of the property and shall restore such areas affected by the Work to their original condition, and, in the event of its failure to do so, the same shall be removed by the Owner at the expense of the Contractor, and the Contractor and/or its surety shall be liable therefore. Final clean-up shall include but not be limited to the following:

1. All finished surfaces shall be swept, dusted, washed and polished. This includes cleaning of the Work of all finishing trades where needed, whether or not cleaning by such trades is included in their respective sections of the specifications.

2. Roofs, utility tunnels, manholes and pipe trenches and spaces between the new and existing Work shall be left thoroughly cleaned.

3. Finished flooring shall be thoroughly cleaned in accordance with the manufacturer’s recommendations.

4. Where the finish of floors has been marred or damaged in any space or area, the entire floor of that space or area shall be refinished as recommended by the manufacturers of the flooring.

5. All equipment shall be in an undamaged, bright, clean, polished and new appearing condition.

6. All new glass shall be washed and polished, both sides. The Contractor shall be responsible for all breakage of glass in the area of the Work from the commencement of its activities until the building is turned over to Owner. The Contractor shall replace all broken glass and deliver the entire building with all glazing intact and clean.

7. Provide new filters for all fan convectors after final cleaning.

8. Refer to exterior clean up. Remove paint and glazing compound from surfaces.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by construction operations. Return adjacent areas to condition existing before construction operations began.

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

1.2 ROOF SYSTEM INVENTORY

A. The Owner shall provide the Contractor with a list of Roof System Attributes to be inventoried in an Excel template and the FM Global form 2688 for roofs.

B. The Contractor shall provide a dimensioned roof plan of the facility drawn to scale, Auto CAD or Microstation format. Each roof panel of the roof system is to be labeled with a unique ROOF ID number that will reference the Excel template to properly inventory Roof System Attributes of each panel. Once populated, the Contractor shall electronically return to the drawings to the Owner's Representative for review and approval.

1. Entire Roof Replacement Projects for a Facility: The Contractor is to assign a ROOF ID to each panel of the newly installed roofing system. The ROOF ID will be comprised of the unique Cornell Facility Code number followed by an underscore and a three digit number. (i.e. - Day Hall (Facility Code: 2026) - ROOF ID: 2006_001).

2. Partial Roof Replacement Projects for a Facility: The Owner will provide a graphically representation of the facility's roof plan with the ROOF ID numbers already assigned to each panel of the roof . The Contractor is responsible to transfer the assigned ROOF ID numbers to their new drawings to be returned to the Owner's representatives.

C. The Contractor shall populate the template. Once populated, the Contractor shall electronically return the list to the Owner's Representative. The initial data to be captured on each panel of the newly installed roof system shall include:

1. Roof Classification
2. Manufacturer (If applicable)
3. Description of System
4. Roof Material
5. Installation Type
6. Slope of Roof (Low or Steep)
7. Roof ID (See Section 1.1.B) for additional information
8. Area of Roof Panel (SF)
9. Contractor (Installer of Roof System)
10. Warranty Number (If applicable)
11. Warranty Expiration Date (If applicable)
12. Material Warranty Number (If applicable)
13. Material Warranty Expiration Date (If applicable)

14. Asbestos Present (If any material remained in place during the reroofing project)
15. Insulation (Yes or No), Fastening type, Thickness
16. Flashing Material
17. Gutter Type (If applicable)
18. Downspout Type (If applicable)
19. Roof Drain Type (If Applicable)
20. Roofing Substrate
21. Facility (State or Endowed)
22. Vapor Barrier Type
23. Installation Date
24. Cost per Square Foot
25. Remaining Useful Life (RUL)
26. Type of Heat Trace Element (If applicable)
27. Type Snow Guard Systems (If applicable)
28. Additional Comments as Applicable

D. The Contractor shall electronically submit the Roof System data as specified above and any related documentation (i.e. - O&M manuals and Warranty data) to the Owner's Representative.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 78 22*****

SECTION 01 78 23 OPERATING AND MAINTENANCE DATA

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

1. Prepare operating and maintenance data as specified in this Section, as referenced in other pertinent sections of Specifications and as necessary to operate the completed Work.

2. Operations and maintenance data, in final format, shall be available to the Owner prior to substantial completion.

B. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.2 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Upload electronic files to ePM system of complete manual in final form.

1. Format:

a. Size: 8-1/2" x 11”.

b. Text: Manufacturer's, scanned .pdf and/or neatly typewritten Word file.

c. Drawings in electronic format

- Drawings are required in PDF format. Drawings shall be in AutoCAD v14 or higher format.

d. Provide divider for each separate product, and major component parts of equipment.

- Provide type description of product, and major component parts of equipment.

- Provide indexed PDF bookmarks.

- Provide a series of files organized in subdirectories with a summary index with hyperlinks to the various documents.

e. Cover: Identify each volume with title "OPERATIONS AND MAINTENANCE INSTRUCTIONS".

List:

- Title of Project
- Identity of separate structure as applicable.
- Identity of general subject matter covered in the manual.

1.3 CONTENT OF MANUAL

A. Table of contents, typewritten, for each volume, arranged in a systematic order.

1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to the content of the volume.
3. List, with each product, the name, address and telephone number of:
   a. Subcontract or installer.
   b. Maintenance contractor, as appropriate.
   c. Identify the area of responsibility of each.
   d. Local source of supply for parts and replacement.
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete reference to inapplicable information.

C. Submittal Data:

1. Include a record copy of the final, approved product submittal. Record copy shall be a clean copy (free of notes from the design professional) which has been updated to reflect the “as-installed” system.

D. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.

b. Control and flow diagrams.

2. Coordinate drawings with information on Record Documents to assure correct illustration of completed installation.

3. Do not use Record Documents as maintenance drawings.

E. Written text, as required to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.

2. Provide a logical sequence of instructions for each procedure.

F. Original copy of each warranty, bond, and service contract issued.

1. Provide information sheet for Owner's personnel, give:

a. Proper procedures in the event of failure.

b. Instances which might affect the validity of warranties or bonds.

1.4 MANUAL FOR MATERIALS AND FINISHES

A. Upload electronic files to ePM system.

B. Content, for architectural products, applied materials and finishes:

1. Manufacturer's data, giving full information on products:

a. Catalog number, size, and composition.

b. Color and texture designations.

c. Information required for reordering special-manufactured products.

d. Certification as to asbestos free

2. Instructions for care and maintenance:

a. Manufacturer's recommendation for types of cleaning agents and methods.

b. Cautions against cleaning agents and methods which are detrimental to the product.

c. Recommended schedule for cleaning and maintenance.

C. Content, for moisture-protection and weather-exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards

b. Chemical composition

c. Details of installation

2. Instructions for inspection, maintenance, and repair.

D. Additional requirements for maintenance data: The respective sections of Specifications.

1.5 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Upload electronic files to ePM system.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.

a. Function, normal operating characteristics, and limiting conditions.

b. Performance curves, engineering data and tests.

c. Complete nomenclature and commercial number of all replaceable parts.

2. Operating procedures:

a. Start-up, break-in, routine and normal operating instructions.

b. Regulation, control, stopping, shutdown and emergency instructions.

c. Summer and winter operating instructions.

d. Special operating instructions.

3. Maintenance Procedures:

a. Routine operations.

b. Guide to "troubleshooting".

c. Disassembly, repair and reassembly.

d. Alignment, adjusting and checking.

4. Servicing and lubrication required:

a. List of lubricants required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

    a. Predicted life of parts subject to wear.

    b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

9. Each contractor's coordination drawings.

    a. As-installed color-coded piping diagrams.

10. Charts of valve tag numbers, with the location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of Specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts:

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data and tests.

    c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panel boards:

    a. Electrical service.

    b. Controls.

    c. Communications.

3. As-installed color-coded wiring diagrams.

4. Operating procedures:

    a. Routine and normal operating instructions.

    b. Sequences required.

    c. Special operating instructions.

5. Maintenance procedures:

   a. Routine operations.

   b. Guide to "troubleshooting".

   c. Disassembly, repair and reassembly.

   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of Specifications.

D. Additional requirements for operations and maintenance data: See the respective sections of Specifications and General Conditions.

1.6 SUBMITTAL REQUIREMENTS

A. Submit through ePM system preliminary draft of proposed formats and outlines of contents of the O&M Manual thirty (30) calendar days after approved submittals.

B. Submit completed data in final form twenty (20) calendar days prior to the Acceptance Phase (final Payment Application) of the Project.

1.7 INSTRUCTIONS OF OWNER'S PERSONNEL

A. Prior to final inspections or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems:

1. Instruction time shall be sufficient to fully instruct all shifts of the Owner's operating and maintenance personnel.

B. Operations and maintenance shall constitute the basis of instruction:

1. Review contents of manual with Owner personnel in full detail to explain all aspects of operations and maintenance.

C. Submit documentation, signed by each of the Owner's Representatives who have been instructed, describing:

1. Method of Instruction.

2. Equipment and Systems Operated.

3. Length of Instruction Period.

D. Contractor is fully responsible until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing.

1.8 OPERATING INSTRUCTIONS

A. Upload in ePM system all operating, maintenance and starting precautions and procedures to be followed by Owner for operating all systems and equipment.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION – NOT USED

*****END OF SECTION 01 78 23*****

SECTION 01 78 36 WARRANTIES AND BONDS

1.0 GENERAL

1.1 DESCRIPTION

The Contractor shall:

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Architect for transmittal to Owner.

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

2. General closeout requirements are included in Section 01 77 00 - "Project Closeout."

3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 through 40.

4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner

1.4 QUALITY ASSURANCE

A. Use adequate care and diligence to review Contract Documents to identify detailed requirements relating to warranties and bonds.

B. Verify that each item required for this submittal conforms with specified requirements.

1.5 WARRANTY REQUIREMENTS

A. In addition to standard and special warranties described in Divisions 2 through 40, Contractor shall warrant work included in this Project, for a minimum period of one (1) year following acceptance of a Certificate of Substantial Completion by Owner, to cover performance, materials, workmanship and compliance with Contract Documents.

B. Corrective Work: Provide service within thirty (30) calendar days when requested by Owner. Perform services during normal working hours, unless specifically directed otherwise by Owner. Coordinate with Owner's representative to schedule performance of corrective work. Where designated service providers cannot perform corrective work within the Owner's required time frame, engage another qualified service provider. Submit a written statement to Owner upon completion of corrective work; document work performed and list outstanding items, if any.

1. When a completed breakdown of a piece of equipment occurs of the malfunction of a system affects the environment or program involving 50 or more persons at a time (employees and students combined), or creates a safety or security risk to the Owner, an EMERGENCY may be declared by the Owner. The Owner may declare an emergency as defined above at which time the service response must be within 4 hours and may require action during non-normal working hours.

2. When an emergency condition occurs, the Owner may take immediate corrective action to relieve the problem by making, a minimum as possible, temporary adjustments and/or repairs when necessary to decrease the problem until the designated Contractor's representative can respond. These temporary adjustments and repairs will in no way jeopardize the existing warranty.

3. The Owner's service staff will advise the Contractor's Representative of all temporary adjustments and repairs done in relation to the malfunctioning equipment or facility.

4. If the Contractor fails to respond with actual service within four (4) hours, and/or the necessary repairs or adjustments are not satisfactorily complete twenty-four (24) hours, the Owner will have the authority to make the necessary repairs or adjustments and charge the Contractor for parts and labor.

5. If all adjustments and repairs done by the Owner in relation to the above conditions are done by authorized district personnel, there will be no negative effect of future warranty claims.

C. Related Damages and Losses: When correcting failed or damaged warranted work, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

D. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

E. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

F. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

G. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or subcontract for materials or units of work for Project where a special project guaranty, specified product warranty, certification, or similar commitment is required until it has been determined that entities required to sign or countersign such commitments are willing to do so.

H. Specific Warranty. Where a special warranty, certification, or similar commitment is required on such work or part of the Work, the Owner reserves the right to refuse to accept the Work until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.6 SUBMITTAL REQUIREMENTS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect or Owner.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect and Owner within fifteen (15) days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for acceptance prior to final execution.

1.7 SUBMITTALS REQUIRED

A. Submit warranties, bonds, and service and maintenance contracts as specified in the respective sections of Specifications. Submit a list of all required warranties.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 FORM OF SUBMITTALS

A. The Warranties and Bonds shall be in electronic pdf format. Each submission shall include the title of the Project and the name of the Contractor.

B. Provide a series of files organized in subdirectories with a summary index with hyperlinks to the various documents and or references.

C. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

D. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Item description.
3. Notation of what the equipment serves (e.g. – Provides perimeter heat)
4. Warranty Provider. Is the warranty provided by a manufacturer or installer?
5. Firm, with name of principal and responsible party, address and telephone number.
6. Scope.
7. Duration.
    a. Date of beginning of warranty, bond or service and maintenance contract
    b. End date of warranty, bond or service and maintenance contract.
8. Provide information for Owner's personnel:
    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.
9. Contractor, name of responsible principal, address and telephone number.

3.2 TIME OF SUBMITTALS

A. Make final submittals within ten (10) days after Date of Substantial Completion, prior to final request for payment.

B. For items of work when acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.

3.3 ROOF WARRANTY PACKAGE

A. Roof warranties shall explicitly denote the specific roof panel identification number (ROOF ID) for which the warranty applies to.

B. Roof panel identification numbers shall be generated in accordance with Section 01 78 22, FIXED EQUIPMENT INVENTORY, in coordination with the Owner's Roof Representative.

C. Roof warranties shall include a dimensioned roof plan with roof panel identification numbers generated in accordance with Section 01 78 22, FIXED EQUIPMENT INVENTORY.

D. Warranty Needs to be posted at all access points to the roof, With following message.

Attention
Roof Under Warranty
Do Not Alter or Repair without written
Approval from Facilities Services
Manufacture: XYZ
Installation Date: 00/00/0000
Warranty Number: 123
Warranty Expiration Date: 00/00/0000
For Immediate Assistance Contact
Roof Program Manager

*****END OF SECTION 01 78 36*****

SECTION 01 78 39 RECORD DOCUMENTS

1.0 GENERAL

1.1 DESCRIPTION

A. The Contractor shall maintain at the site, during construction, one record copy of:

1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract
5. Architect's Field Orders or written instructions.
6. Final Shop Drawings, Product Data and Samples
7. Field Test records
8. Construction photographs

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples apart from documents used for construction.

B. File documents and samples in accordance with the Owner’s electronic project management system document structure.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for review by the Owner’s Representative and the Architect.

1.3 RECORDING

A. Label each document "AS BUILT" in neat, large, printed letters.

B. Record information concurrently with construction progress.

1. Do not conceal any Work until required information is recorded.

C. Survey Mapping

1. Provide an accurate topographic, planimetric, utility map of as-built conditions, and mapped locations and elevations of constructed facilities / elements including as-built and exposed underground utilities. Survey work in progress as required to accurately locate constructed facilities / elements. Survey final condition of project extents at final acceptance.

   a. Site related elements including:

      - Sidewalks, ramps, curbs, and gutters - indicate type and surface material.

      - Streets, driveways, parking areas, labeled with material.

      - Fences, walls, steps, handrails, signs, site furniture and light fixtures labeled with material.

      - Live trees which have a trunk diameter of three inches (3") or greater and all isolated or specimen trees. Measure tree trunk 3' above grade. Indicate approximate trunk diameter, "drip line" and common name of tree.

      - Shrubs, show outlines of shrub masses.

      - Streams and bodies of water.

   b. Utility related elements and supporting infrastructure including:

      - The Contractor shall provide GPS points on all utility infrastructure: water, steam, chilled water, storm, sewer, electric, telecommunications, etc. Data is to be sent to the Owner on a quarterly basis throughout the project.

      - Manholes, catch basins, drain inlets, cleanouts, vent stacks, tanks, underdrains, foundation drains, monitoring wells, detention/retention/filtration facilities. Label type (sanitary or storm), dimensions and material of structure and cover/grate; pipe connections; sizes, materials, direction of flow and invert elevations. Locate and identify size, material, and invert elevations for culverts.

      - Water, gas, central steam, chilled water or other pressure lines, valve boxes, meter boxes, hydrants, tanks, fittings, etc. Label type, size, material, elevations at building walls and all intersections, connections and vertical angle changes.

      - Utility poles, above and below ground lines including but not limited to power, street lighting, traffic control communication and sensors, telephone, television, communication, fire and police call boxes, public communication or display facilities. Label utility as direct buried, in conduit, or concrete encased duct. Identify elevations at building walls and all intersections, connections and vertical angle changes. Label all utilities and associated duct banks or conduits with sizes and materials.

- Existing and abandoned utilities exposed during construction. Show ends of abandoned utilities left in place and assumed continued direction of utilities. Label with information as listed above.

2. Survey mapping shall be done under the personal supervision of a Surveyor, registered in and licensed by the State of New York, who shall certify under his/her seal the accuracy of the survey.

3. Field Survey Accuracy:

   - Horizontal and Vertical mapping shall be ACSM Second Order Class II, 1 in 20,000.

4. Coordinate base:

   - NAD83-86 geodetic system with grid values in the New York Central State Plane coordinate system in feet with elevations in NAVD ’88 in feet.

5. Each different feature shall be drafted on a separate named CAD level/layer in Revit or AutoCAD format using industry standard symbology of color, line style, line weight, and cells.

6. Provide an ASCII file list of coordinates for all survey points including control, feature, and topographic in the following comma delimited format: Point number, Northing coordinate, Easting coordinate, Elevation coordinate, Point description.

7. Topography and spot elevations:

   a. Topographic contours shall be accurately plotted at one foot (1’) contour intervals.

   b. Record spot grade elevations as follows:

      i. Within natural ground and lawn and planted areas, spot elevations shall be shown to one-tenth of a foot (0.1’). Within all areas of built-up improvements such as pavements, curbs, steps, walls, utility and drainage systems or other site improvements, spot elevations shall be shown to one-hundredth of a foot (0.01’).

      ii. Existing grade at building corners; and thresholds and finished floor at all entrance, exit, or access points.

      iii. Develop road cross sections at 50-foot intervals maximum, record spot elevations for all drive centerlines and all beginning radius of street intersections. For each cross section obtain elevations for front and back of existing sidewalk, top and bottom of curb, and centerline of the street. Obtain elevations for centerline intersection of all roads.

      iv. For trees of three inches to eighteen inches (3” - 18”) in diameter, record elevation at high and low side at base of trunk. For specimen trees of eighteen inches (18”) or greater diameter, indicate four (4) spot elevations on the north, south, east, and west at base of each trunk to one-hundredth (.01)

foot elevation.

v. Base, top, corners, and at cheek walls for all steps. Indicate elevations at top and bottom of walls and curbs.

vi. Rim elevations of all catch basins, drain inlets, manholes, valve boxes, slabs on grade. Inverts at all sewer pipes and culverts. Bottom of structure floor and sump.

D. Drawings

As built drawings shall consist of making any changes neatly and clearly on the Contract Drawings using colored ink or pencil, shall be kept current by the contractor on a day-to-day basis in concert with the progress of the Work. Where applicable, the change marked on a drawing is to carry the notation “per Change Order No. X”, or similar reference which cites the reason for the change. As an alternative approach the Contractor can submit a plan for producing the “As-Built” drawings via electronic mark-up in Bluebeam, Adobe Professional, or other similar program as an alternative to colored pencil or ink mark-ups. Such plan shall be subject to approval of the Owner.

The day-to-day construction as built drawings shall be made available to the Architect or Owner’s Representative for review upon request. The "As built" drawings shall show all changes to the following areas of construction:

1. Architectural:

   a. Modifications to components dictated by the building code

   b. Wall, door, window locations

   c. Built in casework locations

   d. New rated door and wall schedules/ locations

   e. Material and products where submittals are requested

2. Civil and Structural

   a. Dimensions for load carrying elements, both horizontal and vertical

   b. Materials and products where submittals are requested

   c. Load carrying elements and foundation systems

   d. Site related elements including:

      - Building outlines, entranceways, areaways, roof overhangs, downspouts, significant architectural projections and other pertinent data.

   e. All significant changes in foundations, columns, beams, openings, concrete reinforcing, lintels, concealed anchorages and "knock-out" panels made during construction.

f. Building envelope systems including roofing systems and building shell systems

g. Geotechnical subsurface information

h. Items that will require future maintenance

i. Life safety critical items

3. Mechanical (HVAC, Plumbing and Fire Protection)

a. Products where submittals are requested

b. Final locations of all equipment.

c. Final sizes and materials of piping and ductwork.

d. Final locations of inaccessible piping and ductwork.

e. Final locations of all controls equipment, including all sensors and actuators.

f. Final locations of all valves and dampers, including all shutoff valves, balance dampers and fire dampers.

g. Location of access doors for all equipment in concealed locations.

h. Final location and arrangement of all mechanical equipment and concealed gas, sprinkler, domestic, sanitary and drainage systems piping and other plumbing, including, but not limited to, supply and circulating mains, principal valves, meters, clean-outs, drains, pumps and controls, vent stacks, sanitary and storm water drainage.

4. Electrical

a. Products where submittals were requested.

b. Circuit (wire and raceway) size, number, and type.

c. Main circuit pathways for Fire Alarm, Emergency Power, and Access Control/Security systems.

d. Final locations of equipment and devices, interior and exterior luminaires, and power supplies.

e. Final location of electric signal system panels, final arrangement of all circuits and any significant changes made in electrical signal system design as a result of Change Order or job conditions.

5. Environmental

a. Utility related elements and supporting infrastructure

b. Storm water maintenance/testing access points

c. Location of unusual excavation findings / contaminated soil (i.e. mercury uncovered during excavation, also on-site spills during construction), including quantity excavated/disposed.

E. Specifications and Addenda

Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or by Change Order.

1.4 SUBMITTAL

A. After completion of Punchlist, submit all record documents through ePM system.

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 81 13 - SUSTAINABLE DESIGN REQUIREMENTS

1.0 GENERAL

1.1 RELATED DOCUMENTS AND SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on USGBC's "LEED Version 4 for Interior Design and Construction."

1. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.

2. A copy of LEED Project checklist is attached at the end of this Section for information only.

    a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of the Project that are not part of the Work of the Contract.

3. Specific requirements for LEED are included in greater detail in other Sections.

4. Certain LEED v4 are being pursued in lieu of LEED v4. Reference LEED checklist for list of these credits.

B. Related Sections:

1. 01 81 16 Low-Emitting Materials Restrictions

2. 01 81 19 "Indoor Air Quality Requirements."

3. 01 91 00 Building Commissioning

4. Divisions 01 through 33: Sustainable requirements specific to the work of each of these Sections.

1.3 DEFINITIONS

A. Alternative Daily Cover (ADC): Material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.

B. Bio-based Materials: A product of plant or animal origin, not including products made by killing the animal. Bio-based raw materials shall be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country.

C. Biopreferred Products: Commercial or industrial products (other than food or feed) that are composed in whole, or in significant part, of biological products, renewable agricultural materials (including plant, animal, and marine materials), or forestry materials and includes biobased intermediate ingredients or feedstocks.

D. CDPH Standard Method: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, for the emissions testing and requirements of products and materials.

E. Chain of Custody (COC): A procedure that tracks a product form the point of harvest or extraction to its end use, including all successive stages of processing, transformation, manufacturing, and distribution.

F. Chain-of-Custody Certificates:

Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that the manufacturer is certified for chain of custody by an FSC-accredited certification body.

G. Chemicals of Concern: Chemicals that are of special concern due to their potential effects on human health and the environment:

1. persistent bio-accumulative toxic (PBT) chemicals;

2. known or suspected human carcinogens.

H. Clean Waste: Nonhazardous materials left over from construction and demolition. Clean waste excludes lead and asbestos.

I. Commingled Waste: Building waste streams that are combined on the project site and hauled away for sorting into recyclable streams. Also known as single-stream recycling.

J. Composite Wood and Agrifiber: Products such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood and/or plant material pressed and adhered together.

K. Construction Waste: EPA defines construction and demolition materials as “debris generated during the construction, renovation and demolition of buildings, roads, and bridges”.

L. Cradle to Cradle (C2C) Product Certification: Standard which assesses and certifies products in five categories, Material Health, Material Reutilization, Renewable Energy and Carbon Management, Water Stewardship, and Social Fairness, as defined by the Cradle to Cradle Products Institute.

M. Cradle to Gate Assessment: Analysis of a product's partial life cycle, from resource extraction (cradle) to the factory gate (before it is transported for distribution and sale). It omits the use and the disposal phases of the product.

N. Cradle to Grave: Analysis of a product's full life cycle, from resource extraction (cradle) to the disposal phase (grave).

O. Declare Product Label: All ingredients of 100 parts-per-million or greater disclosed and evaluated against the current version of the Living Building Challenge Red List, as defined by the International Living Future Institute.

P. Embodied carbon: The carbon footprint of a material. It considers how many greenhouse gases (GHGs) are released throughout the supply chain and is often measured from cradle to (factory) gate, or cradle to site (of use).

Q. Energy Usage Intensity (EUI): is a relative measure of a building's operational energy use per unit of floor area, which is commonly expressed as either kilo-BTU per square foot per year (kBtu/ft2) or kilowatt-hour per square meter per year (kWh/m2).

R. Environmental Product Declaration (EPD): An EPD is an independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and then peer-reviewed. EPDs can be either industry wide (Generic) or Product Specific:

1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.

2. An Industry-wide Environmental Product Declaration (EPD) is a product with a third-party certification, including external verification, in which the manufacturer is explicitly recognized by the program operator. The industry-wide Environmental Product Declaration shall conform to ISO 14025 and 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope. Also referred to as a "generic" Environmental Product Declaration.

3. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator are valued as 1.5 products for the purposes of credit achievement calculation.

S. Extended Producer Responsibility (EPR): Products whose manufacturer has established measures to reclaim its products at the end of their useful life and to recycle them into the same product.

1. Producers must recover and recycle the materials for use in new products of the same type.

2. EPR programs are also known as "closed-loop" or "product take-back".

T. Global Warming Potential: Global warming potential is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide.

U. Greenhouse Gas (GHG) Protocol: establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions.

V. GreenScreen® for Safer Chemicals: A method for comparative chemical hazard assessment and their potential effect on human health and the environment.

W. Green Stormwater Infrastructure: Infrastructure designed to filter and absorb stormwater where it falls.

X. Grey Water: Wastewater that has been used for washing, laundering, bathing, or showering.

Y. Health Product Declaration: A standard format for reporting product content and associated health information for building products and materials.

Z. Indoor Air Quality (IAQ) Management Plan: Plan developed by the contractor to provide a healthy and safe indoor environment for workers during construction as well as the building's current and eventual occupants. The IAQ Management Plan shall meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007 (ANSI/SMACNA 008-2008), Chapter 3.

AA. Inherently non-emitting sources: Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

BB. Inside the Building: Defined as inside the weatherproofing system.

CC. International Living Future Institute (ILFI): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The ILFI is administrator of the Living Building Challenge (LBC) Certification.

DD. International Well Building Institute (IWBI): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The IWBI is administrator of the WELL Building Certification.

EE. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.

FF. LEED: USGBC's "LEED Version 4 for Interior Design and Construction."

1. Definitions that are a part of "LEED Version 4 for Interior Design and Construction" (LEED v4 ID+C) apply to this Section.

2. Where indicated for credit substitutions, definitions that are part of LEED Version 4 for Interior Design and Construction (ID+C), Beta Guide (most recent addenda version) apply to this section.

GG. Life Cycle Assessment (LCA): An evaluation of the environmental effects of a product from cradle to grave, as defined by ISO 14040-2006 and ISO 14044-2006.

HH. Light Reflectance Value: a measure of visible and usable light that is reflected from a surface when illuminated by a light source.

II. Low-Emitting Materials Requirements: As defined in Section 01 8116 "Low-Emitting Materials Requirements"

JJ. Material Cost: The dollar value of materials being provided to the site, after any contractor markups, inclusive of all transportation and tax fees but excluding equipment and labor costs.

KK. Material Transparency: refers to the practice by manufacturers of disclosing the environmental and health impacts of products.

LL. Minimum Efficiency Reporting Value (MERV): Unit of measurement used to report a filter's ability to capture larger particulates between 0.3 and 10 microns (µg).

MM. Multi-Attribute Standard. Sustainable Certification standard that shows impact reduction in several sustainability categories, often including environmental, health, and social.

NN. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.

OO. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.

PP. Net Zero Carbon: refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add is no more than the amount taken away.

QQ. Operational Carbon: as defined by Zero Carbon Standard 1.0, International Living Future Institute, is the Greenhouse Gas emissions associated with the operational energy use of a building. This includes all carbon from energy required to heat and power the building, including but not limited to, lighting, plug loads, heating, cooling, and cooking.

RR. Operational Waste: The waste generated during the operational phase of a building including paper, metal, plastics, confidential waste, and food.

SS. Parts per Billion (ppb) or Micrograms per Liter (µg/L): Unit of measurement, in this case, utilized to measure pollutants.

TT. Parts per Million (ppm) or Milligrams per Liter (mg/L): Unit of measurement, in this case, utilized to measure pollutant

UU. Passive (As Related to MEP): Not part of the active portions of the Mechanical, Electrical, and Plumbing systems, for example piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, faucets, showerheads, and lamp housings.

VV. Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.

WW. Program Operator: An organization that ensures EPDs meet the product category rules (PCRs) for the associated product category. The program operator doesn't do the actual life-cycle assessments. UL Environment is the leading program operator in the United States.

XX. Program Operator: An organization that ensures EPDs meet the product category rules (PCRs) for the associated product category. The program operator doesn't do the actual life-cycle assessments. UL Environment is the leading program operator in the United States.

YY. Rain Water: Precipitation on roof structures.

ZZ. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

3. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.

4. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

5. Recycled content of materials shall be defined in accordance with the International Organization for Standardization document, ISO 14021-1999 – Environmental labels and declarations – self declared environmental claims (Type II environmental labeling). www.iso.org

AAA. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

BBB. Resource Positive: is defined as the practice of storing more carbon than the company emits, eliminating waste and providing cleaner freshwater than the company uses. Amazon buildings will be designed to be resilient to future climate impacts and be positive contributors to the local environment by including advanced water and waste strategies, leverage green infrastructure for stormwater management, and design and operate exterior environments to enhance local ecosystems.

CCC. Resource Positive: is defined as the practice of storing more carbon than the company emits, eliminating waste and providing cleaner freshwater than the company uses. Amazon buildings will be designed to be resilient to future climate impacts and be positive contributors to the local environment by including advanced water and waste strategies, leverage green infrastructure for stormwater management, and design and operate exterior environments to enhance local ecosystems.

DDD. Reused Materials: Reclaimed or salvaged equipment or materials previously used in this or other construction, which extends the lifetime of materials that would be otherwise be discarded.

EEE. The Red List: A list developed by the Living Building Challenge (LBC) composed of the worst in class chemicals and compounds common to building products with an intent to phase products out of production due to the concerns around toxicity and health. Red List Free compliant products can contribute to credits in both LEED and WELL.

1. "Red List Free" (2023) products must not contain any of the following Red List materials or chemicals:

    a. Alkylphenols

    b. Antimicrobials

    c. Asbestos

    d. Bisphenol A (BPA)

    e. Cadmium

    f. California-banned Solvents

    g. Chlorinated Polyethylene and Chlorosulfonated Polyethlene

    h. Chlorobenzenes

    i. Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs)

    j. Chloroprene (Neoprene)

    k. Chromium VI

    l. Chlorinated Polyvinyl Chloride (CPVC)

    m. Formaldehyde (added)

n. Halogenated Flame Retardants (HFRs)

o. Lead (added)

p. Mercury

q. Organotin Compounds

r. Polychlorinated Biphenyls (PCBs)

s. Polycyclic aromatic hydrocarbons (PAHs)

t. Perfluorinated Compounds (PFCs)

u. Phthalates (orthophthalates)

v. Polyvinyl Chloride (PVC)

w. Polyvinylidene Chloride (PVDC)

x. Short Chain and Medium Chain Chlorinated Paraffins

y. Wood treatments containing Creosote, Arsenic or Pentachlorophenol

z. Volatile Organic Compounds (VOCs) in wet applied products

FFF. Restriction of Hazardous Substances (RoHS): A European regulation limiting or excluding some of the worst-in-class chemicals from electrical and electronic equipment. The RoHS Directive currently restricts the use of ten substances: lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), bis(2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate (BBP), dibutyl phthalate (DBP) and diisobutyl phthalate (DIBP). RoHS compliant products are compliant with mandatory requirements and can contribute to a credit in WELL.

GGG. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:

1. In every case, indicate the location of final assembly.

2. For harvested products, indicate location of harvest.

3. For extracted (i.e. mined) products, indicate location of extraction.

4. For recovered products, indicate location of recovery.

5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.

6. Acceptable Evidence:

   a. Manufacturer’s certification.

   b. Life cycle analysis (LCA) performed by third-party.

HHH. Stormwater: Rainwater or melted snow that runs off streets, lawns and other sites. When stormwater is absorbed into soil, it is filtered and ultimately replenishes aquifers or flows into streams and rivers.

III. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified and labeled by The Forest Stewardship Council as FSC 100%, FSC Mixed, or FSC Recycled.

1. FSC 100%: Label indicating that the wood within the product comes entirely from FSC-certified, well-managed forests.

2. FSC Recycled: Label indicating that the wood or paper in the product comes from reclaimed or re-used material.

3. FSC Mix: Label indicating that the wood within the product is from FSC-certified forests, recycled material, or controlled wood. While not FSC-certified, controlled wood cannot be illegally harvested, harvested in violation of traditional and civil rights, harvested in forests where high conservation values are threatened, harvested in forests being converted to plantations or non-forest use, or harvested in forests where genetically modified trees are planted.

JJJ. United States Green Building Council (USGBC): A non-profit group of leaders from every sector of the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work. The USGBC is administrator of the LEED Green Building Rating Systems.

KKK. Volatile Organic Compound (VOC): Carbon compounds considered indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and wellbeing of installers and occupants.

LLL. Waste Diversion: A management activity that disposes of waste through methods other than incineration or landfilling. Examples include reuse and recycling.

MMM. WELL: A health and wellness building certification program based on a set of mandatory requirements (preconditions) and optional features (optimizations) where projects earn points to achieve different levels of certification through a combination of building design, operations of the certified space, and policies for occupants of it. WELL certification is performance based, requiring third party audit of conditions reflective of intended occupancy. More information is available at www.wellcertified.com, and the knowledge base of the “Resources” section.

NNN. Wet Applied Products: Materials and products installed in wet form that have South Coast Air Quality Management District (SCAQMD) rules relating to VOC associated with them. These include the following:

1. SCAQMD Rule 1113: Architectural Coatings

2. SCAQMD Rule 1168: Adhesive and Sealant Applications

1.4 PROJECT GOALS

A. The proposed project is designed to be sustainable, with the intent of incorporating the following qualities:

1. The project will minimize its effect on the environment by selecting environmentally friendly building materials and utilizing sustainable construction practices.

2. The project will provide a healthy and comfortable space for its occupants by developing and following an Indoor Air Quality Management Plan during construction, by selecting only non-toxic and low-emitting materials, and by designing the building's systems to provide tenants with exceptional indoor air quality.

3. The finished project will consume significantly less energy and water than a typical code-compliant building through the use of premium efficiency equipment and designing efficient building systems.

4. Detailed requirements for addressing specific chemicals of concern are included in Division 2-32 sections that follow. Beyond these material requirements, contractor is encouraged to avoid chemical flame retardants (unless required by code), antimicrobials, and per- and polyfluoroalkyl substances in other building materials.

1.5 MEETINGS

A. LEED Coordination Conference: Schedule a LEED coordination conference before starting construction, at a time convenient to Owner, Architect, and Commissioning Agent.

1. Agenda: Discuss items of significance that could affect complying with requirements for LEED certification, including the following:

a. LEED Project Checklist.

b. General requirements for LEED-related procurement and documentation.

c. Project closeout requirements and LEED certification procedures.

d. Role of LEED coordinator.

e. Construction waste management.

f. Construction operations and LEED requirements and restrictions.

B. Preinstallation Conference: Conduct conference at Project site. Review sustainability requirements and action plans for complying with requirements.

C. LEED Certification Meetings: Schedule and conduct separate LEED Certification meetings as required. Meeting attendees shall include at least the following: Owner's Representative, Architect, Contractor's Project Manager, Contractor's LEED Representative, and Sub-Contractor Representatives as appropriate to stage of Work. Discuss LEED Certification at Pre-bid, Pre-construction, and regular job site meetings.

D. LEED Training Program: Provide environmental training for subcontractors performing Work on the Project site. Training shall include the following:

1. LEED Orientation Program: Requirements for this project.

2. Procedures for identifying the sustainable design and construction requirements for each trade contractor, as defined through the drawings and specifications.

3. Procedures for providing Sustainable Building submittals.

4. Procedures related to the project's Construction Waste Management, Indoor Air Quality Management, and Construction Activity Pollution Prevention Plans.

5. Coordinate with the Owner's LEED Consultant for assistance in conducting the LEED orientation program.

1.6 ADMINISTRATIVE REQUIREMENTS - LEED

A. Contractor's LEED Representative: Must be an experienced LEED-Accredited Professional with demonstrated LEED project experience to coordinate LEED requirements to:

1. Oversee the sustainable building activities for the project.

2. Instruct workers concerning the sustainable building goals.

3. Be present on site on a regular basis when Work is in progress.

4. Prepare and oversee all LEED related submittals.

5. Complete final LEED documentation including LEED online construction credits.

B. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

C. Submit documentation to USGBC and respond to questions and requests from USGBC about LEED prerequisites and credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until USGBC has made its determination on Project's LEED certification application.

1. Document correspondence with USGBC as informational submittals.

D. Contractor is responsible for submitting and installing products in accordance with the Sustainable Material Performance requirements outlined as well as:

1. PRODUCT DATA REPORTING FORM Coversheet: All project submittals shall be accompanied by a completed LEED coversheet. Submittal packages shall also include documentation in support of the sustainability claims made on the LEED coversheet, including:

a. Cost of each material or product, excluding labor and equipment

b. From manufacturer, for each product‘s environmental attributes. This includes a report describing raw materials suppliers, complete content inventory for the product, and/or environmental product declaration.

c. Highlight compliance with all requirements for low-emitting materials as noted in Part 2 (Products).

2. Providing and following an Erosion and Sedimentation Control Plan.

3. Providing and following a Construction Waste Management Plan and ongoing documentation of construction and demolition waste recycling / salvage rates for all categories of waste. See Section 01 7419 - Construction Waste Management and Disposal.

4. During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter

5. LEED consultant to maintain Materials Credit and Low Emitting Tracking Sheet monitoring the project’s progress regarding Materials and Resources goals. Tracking Sheet to be presented at construction meetings.

6. Contractor to complete and submit a LEED Materials Plan within no more than 30 days after the start of the project. The LEED Materials Plan shall indicate estimated total material costs, a sustainably sourced listing of materials targeting the raw material sourcing project goals. The Materials Plan is to be updated on a monthly basis throughout project construction.

7. Contractor to provide Commissioning Authority with a copy of approved submittals for all equipment to be commissioned as well as documentation requested by the Commissioning Authority which is necessary for the commissioning process. This may include: detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information including all responsibilities of the Owner to keep the warranty in force clearly identified. The actual field checkout sheet forms to be used by the factory or field technicians shall be provided to the Commissioning Authority.

1.7 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.

1.8 LEED DOCUMENTATION SUBMITTALS

A. For all credits: LEED documentation submittals shall be prepared and submitted using the LEED-Online Credit web-based application (https://www.usgbc.org/leedonline/) and minimum system requirements.

1. Once the Contractor has joined the project through LEED-Online, the LEED Project Administrator will assign the LEED credits that the contractor is responsible for completing.

a. NOTE: LEED Online is only accessible through Safari, Internet Explorer and Firefox at this time.

b. NOTE: Each "Credit Form" is an editable Adobe PDF document. It may be completed or updated at any time prior to the LEED Construction Submittal. After you have completed documenting the credit, use the 'Save' button at the lower right-hand corner of the Form to save the data online.

c. Additional submittal documentation and backup requirements should be uploaded to the "File Uploads" section of LEED-Online following the required documentation support for each credit.

B. LEED EA credit Optimize Energy Performance: Product data for appliances and equipment that are the responsibility of the contractor. Eligible appliances and equipment must be Energy Star rated. Include rated power in submittal documentation.

C. LEED EA prerequisite Building-Level Energy Metering: Product data for meters, sensors, and data collection system used to provide continuous metering of building energy-consumption performance.

D. LEED MR prerequisite and credit Construction and Demolition Waste Management: Comply with submittal requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

E. LEED MR credit Building Product Disclosure and Optimization: Environmental Product Declarations complying with LEED requirements.

1. Publicly available life cycle assessment conforming to ISO 14044 and having at least a cradle to gate scope

2. Manufacturer's product specific Type III EPD, internally reviewed, in accordance with ISO14071, conforming to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

a. For Division 03: Concrete: 03300 Cast-In-Place Concrete:

1) Provide a product-specific EPD for 90% by volume for all concrete mixes.

The EPD should include global warming potential (GWP) information in the form of kgCO2e/yd3.

2) The following targets should be pursued, where feasible, based on the National Ready Mixed Concrete Association (NRMCA) December 2021 regional benchmarking study Eastern Region Mix corresponding to the mixture's strength class:

a) Option 1: Minimum of 15% GWP reduction. Mixes requiring high early strength may increase the NRMCA benchmark to 30%

b) Option 2: Demonstrate an average of 20% reduction in GWP for total concrete volume.

3) Provide a document defining the proposed methods to achieve GWP reductions prior to construction, and a final report demonstrating total concrete embodied carbon within 6 weeks of completion of concrete work.

3. Industry-wide Type III EPD, externally verified, which conforms to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

a. LEED MR credit Building Product Disclosure and Optimization: Option 2: Embodied Carbon/LCA Optimization

1) Manufacturer's life cycle assessment (LCA) action plan or carbon optimization report demonstrating the required embodied carbon and/or LCA impact reductions compared to baseline and referencing a product-specific LCA or product specific Type III EPD or Industry-wide Type III EPD.

F. LEED MR credit Building Product Disclosure and Optimization, Sourcing of Raw Materials: Option 2, Leadership Extraction Practices.

1. Extended Producer Responsibility: Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.

2. Bio-Based Materials: Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.

3. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.

4. Materials Reuse: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.

5. Recycled Content: Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and pre-consumer recycled content for products having recycled content. Include statement of costs.

G. LEED MR credit Building Product Disclosure and Optimization, Material Ingredients Option 1, Material Ingredient Reporting and WELL optimization X07 Material Transparency.

1. Material ingredient reports for products that comply with LEED credit and WELL optimization requirements for material ingredient reporting, including but not limited to the following:

    a. Manufacturer Inventory.

    b. Health Product Declaration.

    c. Cradle to Cradle certifications.

    d. Declare product labels.

    e. UL Product Lens certifications.

    f. ANSI/BIFMA e3 Furniture Sustainability Standard.

H. LEED MR credit Building Product Disclosure and Optimization, Material Ingredients Option 2, Material Ingredient Optimization and WELL optimization X08 Materials Optimization.

1. Reports showing a compliant material ingredient optimization report or action plan.

I. Indoor Air Quality: Comply with submittal requirements of Section 018120 - CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.

J. LEED credit IEQ Low-Emitting Materials and WELL optimization X06 VOC Control: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, as indicated on drawings, for applicable categories:

1. Paints and coatings.

2. Adhesives and sealants.

3. Flooring.

4. Products containing composite wood or agrifiber products or wood glues.

5. Thermal and acoustic insulation.

6. Wall panels.

7. Ceiling products.

8. Furniture.

K. Indoor Air Quality Assessment: Refer to Section 01 8119

1.9 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide a statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Plumbing.

2. Mechanical.

3. Electrical.

4. Specialty items such as elevators and equipment.

5. Wood-based construction materials.

C. Sustainable Design Action Plans: Provide preliminary submittals within 30 days of date established for commencement of the Work indicating how the following requirements will be met:

1. List of proposed products with LEEDv4 MRc Environmental Product Declarations in sufficient quantities to meet or exceed Option 2: Embodied Carbon/LCA Optimization. The targeted list must include at least 10 products from 3 manufacturers which have a qualifying embodied carbon optimization report or action plan.

2. List of proposed products complying with requirements for LEEDv4 MRc Sourcing of Raw Materials, in sufficient quantities to meet or exceed Option 2. Material Ingredient Optimization. The targeted list must include at least 10 products from 3 manufacturers which have a compliant material ingredient report or action plan.

3. List of proposed products complying with requirements for material LEEDv4 MRc Material Ingredients ingredient reporting, in sufficient quantities to meet or exceed Option 2.

4. Material Ingredient Optimization. The targeted list must include at least 10 products from 3 manufacturers which have a compliant material ingredient report or action plan.

5. Waste management plan complying with Section 01 7419 "Construction Waste Management and Disposal."

6. Construction IAQ management plan.

D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans.

1. The “Product Data Reporting Form” contains information tracking the Building Product Disclosure and Optimization credits.

2. Waste reduction progress reports complying with Section 01 7419 "Construction Waste Management and Disposal."

3. VOC Products progress reports showing the adhesives/sealants, paints/coatings, flooring, and composite wood used on the project.

1.10 CLOSEOUT SUBMITTALS

A. The Contractor shall assemble the Green Building Submittal information outlined into one (1) package submitted in electronic format at project completion. This includes one consolidated electronic (Excel) copy of the LEEDv4 MR Building Products Calculator, LEEDv4 Low-Emitting Materials Calculator, as well as electronic copies of Product Cut Sheets, MSDS, Vendor letters, Vendor invoices, and any other required information. Documentation should be organized per LEED credit.

B. The Contractor shall prepare final documentation as required by Section 01 7419 Construction Waste Management.

C. The Contractor shall complete final documentation as required by Section 01 8119 Construction Indoor Air Quality Management.

2.0 PRODUCTS

2.1 SUSTAINABLE MATERIALS

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

1. Plumbing, Mechanical, Electrical, specialty equipment, and temporary materials are excluded from this requirement.

B. Environmental product declarations LEED v4:

1. EPD Disclosure: Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria below.

a. Product-specific declaration. Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope are valued as one quarter (¼) of a product for the purposes of credit achievement calculation.

b. Environmental product declarations which conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

c. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator are valued as one whole product for purposes of credit achievement calculation.

d. Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator are valued as one half (½) of a product for purposes of credit achievement calculation.

e. USGBC approved program – Products that comply with other USGBC approved environmental product declaration frameworks.

2. EPD Optimization: Use at least 10 permanently installed products sourced from at least three different manufacturers. Products will be valued as below.

a. Life Cycle Impact Reduction Action Plan (value at ½ product)

1) The manufacturer has produced a product specific LCA using EN 15804 or ISO 21930 for the product and has provided a publicly available action plan to mitigate or reduce life cycle impacts. The action plan must be product-specific using the specified PCR functional unit, be critically reviewed, and must include the following information:

b. Life Cycle Impact Reductions in Embodied Carbon.

1) Products that have demonstrated environmental impact reductions for the specified functional unit based on a current third-party EPD or verified LCA that conforms to the comparability requirements of ISO 14025 and ISO 21930.

C. Sourcing of Raw Materials LEED v4: Provide products which meet at least one of the responsible extraction criteria below for at least 25%, by cost, of the total value of permanently installed building products in the project. Products sourced within 100 miles (160 km) of the project site are valued at 200% of their cost.

1. Extended producer responsibility. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.

2. Bio-based materials. Bio-based products shall meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials shall be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material. Products meeting bio-based materials criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

3. New wood products. Wood products shall be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

4. Materials reuse. Reuse includes salvaged, refurbished, or reused products. Products meeting materials reuse criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

5. Recycled content. Recycled content is the sum of postconsumer recycled content plus one-half the pre-consumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

6. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.

7. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

8. USGBC approved program. Other USGBC approved programs meeting leadership extraction criteria.

D. Material Ingredients LEED v4:

1. Material ingredient reporting: Provide at least 20 permanently installed products from manufacturers that use any of the following programs to demonstrate the chemical inventory of the product. Products shall be sourced from at least 5 different manufacturers. Compliant products shall have chemicals inventoried to at least 0.1% (1000 ppm).

   a. Manufacturer Inventory. The manufacturer has published complete content inventory for the product following these guidelines:

      1) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN) and/or European Community Number (EC Number).

      2) Materials defined as trade secret or intellectual property may withhold the name and/or CASRN/EC Number but must disclose ingredient/chemical role, amount and hazard score/class using either:

      3) Greenscreen benchmark, as defined in Green Screen v1.2.

      4) The Globally Harmonized System of Classification and Labeling of Chemicals rev.6 (2015) (GHS)

         a. The hazard screen must be applied to each trade secret ingredient and the inventory lists the hazard category for each of the health hazards included in Part 3 of GHS (e.g. “GHS Category 2 Carcinogen”).

   b. Health Product Declaration. The end use product has a published, complete Health Product Declaration in compliance with the Health Product Declaration Open Standard.

   c. Cradle to Cradle. Product has Material Health Certificate or is Cradle to Cradle Certified™ under standard version 2 Basic level or Cradle to Cradle version 3 with a Material Health achievement level at the Bronze level or higher.

   d. Declare. The Declare product label must meet the following requirements:

      1) Declare labels designated as Red List Free or Declared.

2) Declare labels designated as Red List Approved that demonstrate content inventory to 0.1% (1000 ppm).

e. ANSI/BIFMA e3 Furniture Sustainability Standard. The documentation from the assessor or scorecard from BIFMA must demonstrate the product earned at least 3 points under 7.5.1.3 Advanced Level in e3-2014 or 3 points under 7.4.1.3 Advanced Level in e3-2012.

f. Cradle to Cradle Material Health Certificate. The product has been certified at the Bronze level or higher and at least 90% of materials are assessed by weight.

g. UL Product Lens Certification.

h. Facts – NSF/ANSI 336 Sustainability Assessment for Commercial Furnishings Fabric

i. USGBC approved program. Other USGBC approved programs meeting the material ingredient reporting criteria.

2. Material Ingredient Optimization: Use permanently installed products from at least three different manufacturers that document their material ingredient optimization using the paths below. Choose either 10 compliant products, from 3 different manufacturers.

a. Material Ingredient Screening and Optimization Action Plan (value at ½ product)

1) The manufacturer has screened the product to at least 1,000 ppm and has provided a publicly available inventory meeting the requirements of Option 1 and completed a detailed action plan to mitigate or reduce known hazards using the principles of green chemistry. The action plan must be product-specific(not company, manufacturer or brand), and must include the following information:

b. Advanced Inventory & Assessment (value at 1 product). The end use product meets the requirements of any of the following:

1) Manufacturer Inventory or Health Product Declaration: The product has demonstrated a chemical inventory to at least 0.01% by weight (100 ppm) with no GreenScreen LT-1 hazards or GHS Category 1 hazards. The HPD or Manufacturer Inventory must be third party verified.

2) Manufacturer Inventory or HPD: The product has demonstrated a chemical inventory to at least 0.01% by weight (100ppm) and at least 75% by weight of product is assessed using GreenScreen Benchmark assessment. The remaining 25% by weight of product has been inventoried. The GreenScreen assessment must be publicly available. The HPD or Manufacturer Inventory must be third-party verified.

3) Declare labels designated as Red List Free that are third-party verified.

4) Cradle to Cradle. Product has Material Health Certificate or is Cradle to Cradle Certified™ under standard version 3 or later with a Material Health achievement level at the Bronze level or higher.

c. Material Ingredient Optimization (value at 1.5 products) - The end use product has demonstrated a product inventory and assessment of ingredients using any of the following programs:

1) Manufacturer Inventory or HPD: The product has demonstrated a chemical inventory to at least 0.01% by weight (100ppm) and at least 95% by weight of product is assessed using GreenScreen Benchmark assessment. No Benchmark 1 hazards (BM-1) are present in the end use product. The remaining 5% by weight of product not assessed has been inventoried and screened using GreenScreen List Translator and no GreenScreen LT-1 hazards are present in the end use product. The documents must be third party verified.

2) Cradle to Cradle. Product has Material Health Certificate or is Cradle to Cradle Certified™ under standard version 3 or later with a Material Health achievement level at the Silver level or higher.

d. International Alternative Compliance Path – REACH Optimization (value at 100% of cost or 1 product)

1) End use products and materials have fully inventoried chemical ingredients to 100 ppm and assess each substance against the Authorization List – Annex XIV, the Restriction list – Annex XVII and the SVHC candidate list, (the version in effect June 2013,) proving that no such substance is included in the product. If the product contains no ingredients listed on the REACH Authorization, Restriction, and Candidate list.

E. LEEDv4 WEp Building Level Water Metering: Product cut sheet for the whole-building water meter.

F. LEEDv4 WEc Indoor Water Use Reduction: Product cut sheets for water fixtures, highlighting flow rates and WaterSense rating if applicable. Eligible water-using appliances and equipment must be Energy Star rated. Include water consumption data in submittal documentation.

1. All eligible newly installed fixtures and fittings are WaterSense labeled (or local equivalent for projects outside the U.S.).

2. Residential clothes washers:

a. ENERGY STAR or performance equivalent

3. Commercial clothes washers:

a. CEE Tier 3A

4. Residential dishwashers (standard and compact)

a. ENERGY STAR or performance equivalent

5. Prerinse spray valves

   a. ≤ 1.3 gallons per minute (gpm)

6. Ice machine

   a. ENERGY STAR or performance equivalent and use either air-cooled or closed-loop cooling, such as chilled or condenser water system

G. LEEDv4 EAc Optimize Energy Performance: Product data for appliances and equipment that are the responsibility of the contractor. Eligible appliances and equipment must be Energy Star rated. Include rated power in submittal documentation.

H. LEEDv4 EAp Building-Level Energy Metering: Product data for meters, sensors, and data collection system used to provide continuous metering of building energy-consumption performance.

I. LEEDv4 EAp/EAc Fundamental and Enhanced Refrigerant Management: For equipment containing refrigerants, provide equipment type and size, and, refrigerant type. No CFC-based refrigerants are included in any new mechanical cooling or refrigeration equipment serving the project. This prerequisite does not address equipment with less than 0.5 lb (225 g) of refrigerant.

2.2 LOW-EMITTING MATERIALS

A. Comply with Section 01 8116 “Low-Emitting Materials Restrictions.”

2.3 INDOOR AIR QUALITY

A. Comply with Section 01 8119 “Construction Indoor Air Quality Management.”

3.0 EXECUTION

3.1 CONSTRUCTION ACTIVITY POLLUTION PREVENTION

A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3."

1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 5000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.

2. Replace all air filters immediately prior to occupancy.

3.2 NONSMOKING BUILDING

A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.3 COMMISSIONING

A. Comply with Division 01 Section "General Commissioning Requirements".

3.4 ATTACHMENTS

A. PRODUCT DATA REPORTING FORM follows this Section and is available in MS Excel format for Contractor's use.

B. LEED Checklist.

*****END OF SECTION 01 81 13*****

SECTION 01 81 16 - LOW-EMITTING MATERIALS RESTRICTIONS

1.0 GENERAL

1.1 SUMMARY

A. Section includes:

1. Requirements for Indoor-Emissions-Restricted products.
2. Requirements for VOC-Content-Restricted products.
3. Certification that non-compliant products are not installed on Project.

1.2 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Interior thermal and acoustical insulation.
7. Free-standing furniture.
8. Exterior applied products (for Healthcare and Schools projects only).
9. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Wet-applied roofing and waterproofing.
4. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers; including firestopping sealants and duct joint sealers.

F. Inherently non-emitting sources: Products that are inherently non-emitting sources of VOCs are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

1. Stone.

2. Concrete.

3. Clay brick.

4. Metals that are plated, anodized, or powder-coated.

5. Glass.

6. Ceramics.

7. Solid wood flooring that is unfinished and untreated.

G. Composite Wood: Products composed of wood or plant particles or fibers bonded by a synthetic resin or binder; including the following:

1. Particleboard.

2. Medium-density fiberboard (MDF).

3. Plywood.

4. Oriented-strand board (OSB).

5. Wheatboard.

6. Strawboard.

1.3 REFERENCE STANDARDS

A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict of referenced standards and this specification or within the standards themselves, the more stringent standard or requirement shall govern.

1. Rule 1168 - "Adhesive and Sealant Applications", South Coast Air Quality Management

District (SCAQMD), State of California http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1168.pdf

2. Rule 1113 - "Architectural Coatings": South Coast Air Quality Management District (SCAQMD), State of California http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1113.pdf

3. Green Seal Paint Standard GS-11, Green Seal, Inc., Washington, DC. https://greenseal.org/standards/gs-11-paints-coatings-stains-and-sealers/

4. Green Seal Commercial Adhesive Standard GS-36, Green Seal, Inc., Washington, DC https://greenseal.org/standards/gs-36-adhesives-for-commercial-use/

5. California Air Resources Board (CARB) 2007 https://ww2.arb.ca.gov/our-work/programs/coatings/architectural-coatings

6. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

7. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

8. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association.

9. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating.

10. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.

11. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board.

12. CHPS (HPPD) - High Performance Products Database.

13. CRI (GLP) - Green Label Plus Testing Program - Certified Products.

14. SCS (CPD) - SCS Certified Products.

15. UL (GGG) - GREENGUARD Gold Certified Products.

1.4 ADMINISTRATIVE REQUIREMENTS

A. If the criteria required for LEED suitable VOC content is not met the Contractor shall calculate VOC's using the "VOC budget process" to demonstrate compliance.

1.5 SUBMITTALS

A. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

B. Sustainable Design Reporting: Submit evidence of compliance.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either (1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.6 QUALITY ASSURANCE

A. VOC Emissions Evaluation - Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.

1. Wet-Applied Products: State amount applied in mass per surface area.

2. Paints and Coatings: Test tinted products, not just tinting bases.

3. Evidence of Compliance: Acceptable types of evidence are the following;

a. Current UL (GGG) GREENGUARD Gold certification.

b. Current SCS (CPD) Floorscore certification.

c. Current SCS (CPD) Indoor Advantage Gold certification.

d. Current listing in CHPS (HPPD) as a low-emitting product.

e. Current CRI (GLP) certification.

f. Test report showing compliance and stating exposure scenario used.

4. Product data submittal showing VOC content is NOT acceptable evidence.

5. Manufacturer's certification without a test report by an independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Report of laboratory testing performed in accordance with requirements.

b. Published product data showing compliance with requirements.

c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) or EPA TSCA VI for ultra-low emitting formaldehyde (ULEF) resins.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.

b. Report of laboratory testing performed in accordance with requirements.

c. Published product data showing compliance with requirements.

d. Wood structural panel manufactured according to PS 1-09 or PS 2-10 (or one of the standards considered by CARB to be equivalent to PS 1 or PS 2) and labeled bond classification Exposure 1 or Exterior

e. Structural wood product manufactured according to ASTM D 5456 (for structural composite lumber), ANSI A190.1 (for glued laminated timber), ASTM D 5055 (for I-joists),ANSI PRG 320 (for cross-laminated timber), or PS 20-15 (for finger-jointed lumber).

D. Flooring: Flooring shall comply with the 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."

E. Ceilings, Walls, and Insulation: Ceilings, walls, and thermal insulation shall comply with the 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."

F. Furnishings Emissions Standard and Test Method: BIFMA e3-2014e (updated version) or e3-2019(updated version) Sections 7.6.1 and 7.6.2, tested in accordance with ANSI/BIFMA M7.1-2011(R2016).

1. Evidence of Compliance:

a. Test report showing compliance and stating exposure scenario used.

2. Any furniture procured as part of this project must meet the Healthier Hospitals Initiative:

Healthy Interiors (HHI-Healthy Interiors) standard for 100% of furniture, including being free of chemical flame retardants, unless required by code.

G. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

2.0 PRODUCTS

2.1 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. VOC Emissions Evaluation - Product Requirements:

1. Paints and Coatings: CAL (CDPH SM).

2. Adhesives and Sealants: CAL (CDPH SM).

3. Flooring: CAL (CDPH SM).

4. Insulation: CAL (CDPH SM).

5. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.

6. Furnishings: Comply with Furnishings Emissions Standard and Test Method.

7. Exceptions: Inherently Non-Emitting Materials are not required to have VOC emissions testing.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:

1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.

2. Aerosol Adhesives: GreenSeal GS-36.

3. Joint Sealants: SCAQMD 1168 Rule.

4. Paints and Coatings: Each color; most stringent of the following:

a. 40 CFR 59, Subpart D.

b. SCAQMD 1113 Rule.

c. CARB (SCM).

5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

D. Chemical Content: Products shall be free of halogenated and organophosphorous flame retardants, per- and polyfluoroalkyl substances (i.e. stain and water repellants), antimicrobials, and fly ash.

E. Building products shall be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2–2017, using the applicable exposure scenario. Organizations that certify manufacturers' claims must be accredited under ISO Guide 65. Laboratories that conduct the tests specified in this credit must be accredited under ISO/IEC 17025 for the test methods they use. The manufacturer or third-party's certification shall state the exposure scenario used to determine compliance and shall state the range of total VOCs after 14 days. Claims of compliance for wet-applied products shall state the amount applied in mass per surface area. Statements of product compliance must follow product declaration guidelines in CDPH Standard Method v1.2-2017, Section 8. Manufacturer statements must also include a summary report from the laboratory that is less than three years old.

F. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) shall be disclosed.

G. Methylene chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, or sealants.

2.2 INTERIOR ADHESIVES

A. VOC Limits

1. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, and adhesive primers used on the interior of this Project shall not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.

2. The VOC limits defined by SCAQMD are measured in grams per liter (g/L), less water and less exempt compounds.

3. General: For specified building construction related applications, the allowable VOC content is as follows:

a. Architectural Applications:

1) Building Envelope Membrane Adhesive 250

2) Carpet Pad Adhesive 50

3) Ceramic Tile Adhesive 65

4) Cove base adhesive 50

5) Drywall and panel adhesive 50

6) Multipurpose construction adhesive 70

7) Roofing

a) Single ply roof membrane adhesives 250

b) All other roof adhesives 250

8) Rubber Floor Adhesive 60

9) Structural glazing adhesive 100

10) Structural wood member adhesives 140

11) Subfloor adhesive 50

12) VCT and asphalt tile adhesive 50

13) Wood Flooring Adhesive 100

14) All other indoor floor covering adhesives 50

15) All other outdoor floor covering adhesives 50

b. Specialty Applications:

1) Contact Adhesive 80

2) Edge glue adhesive 250

3) All other plastic cement

a) ABS welding 325

b) ABS to PVC transition cement 510

c) PVC welding 510

d) CPVC welding 490

e) All other plastic welding cements 250

4) Adhesive primer for plastic 550

5) Special Purpose Contact Adhesive 250

6) Adhesive Primer for Traffic Marking Tape 150

7) Structural Wood Member Adhesive 140

8) Top and trim adhesive 250

c. Substrate Specific Applications:

1) Metal to metal 30

2) Plastic foams 50

3) Porous material (except wood) 50

4) Wood 30

5) Fiberglass 80

6) Reinforced Plastic Composite 200

d. Other

1) Other adhesives 250

2) Adhesive bonding primers 250

3) Adhesive primers, or any other primers 250

e. Adhesive Primers:

1) Plastic 550

2) Pressure sensitive 785

3) Traffic marking tape 150

4) All other adhesive primers 250

2.3 INTERIOR SEALANTS

A. VOC Limits

1. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, sealant primers and sealants used on the interior of this Project shall not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.

2. The VOC limits defined by SCAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.

3. General: For specified building construction related applications, the allowable VOC content is as follows:

a. Sealants:

1) Clear, Paintable, and Immediately

Water-Resistant Sealant 250

2) Foam insulation and sealant 250

3) Grout Sealant 65

4) Non-Staining Plumbing Putty 150

5) Potable Water Sealant 100

6) Single Ply Roof Membrane Sealants 450

7) Other Roof Sealants 300

8) All other Architectural Sealants 50

9) All other Sealants 420

b. Sealant Primer:

1) Architectural - Nonporous 250

2) Architectural- Porous 775

3) Modified Bituminous 500

4) Other 750

2.4 INTERIOR ARCHITECTURAL PAINTS

A. VOC Limits

1. VOC Content Requirements for Wet Applied Products: All paints and coatings wet-appliedon site must meet the applicable VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016. Product specific requirements are as follows:

a. Paints

1) Flat 50

2) Non-Flat 100

3) Non-Flat High Gloss Coatings 150

b. Coatings:

1) Aluminum roof coatings 100

2) Basement specialty coatings 400

3) Bituminous roof coatings 50

4) Bituminous roof primers 350

5) Bond breakers 350

6) Building envelope coatings 50

7) Concrete curing compounds 100

8) Concrete/Masonry Sealers 100

9) Concrete Surface Retarders 50

10) Dry fog coatings 50

11) Faux finishing coatings

    a) Clear topcoat 100

    b) Decorative coatings 350

    c) Glazes 350

    d) Japan 50

    e) Trowel applied coatings 50

12) Fire resistive Coatings 150

13) Floor coatings 50

14) Form-release compounds 100

15) Graphic arts coatings (sign paints) 200

16) High temperature coatings 420

17) Industrial maintenance coatings 100

    a) Color indicating safety coatings 480

    b) High temperature IM coatings 420

    c) Non-sacrificial anti-graffiti coatings 100

    d) Zinc-rich IM primers 100

18) Low-Solids Coatings 120

19) Magnesite cement coatings 450

20) Mastic texture coatings 100

21) Metallic pigmented coatings 150

22) Multi-color coatings 250

23) Pre-treatment wash primers 420

24) Primers, Sealers, and Undercoaters 100

25) Reactive penetrating sealers 350

26) Recycled coatings 250

27) Roof Coatings 50

28) Rust Preventative Coatings 100

29) Sacrificial Anti-Graffit Coatings 50

30) Shellacs

a) Clear 730

b) Opaque 550

31) Specialty primers, sealers, and undercoaters 50

32) Stains 250

33) Stone Consolidants 450

34) Swimming Pool Coatings 340

35) Tile and Stone Sealers 100

36) Traffic Marking Coatings 100

37) Tub and Tile refinish Coatings 420

38) Waterproofing Membranes 100

39) Wood Coatings 275

40) Wood Preservatives 350

41) Zinc-rich Primers 340

2.5 INTERIOR COATINGS

A. VOC Limits

1. The volatile organic compound (VOC) content of all field-applied coating used on the interior of this Project shall not exceed the limits defined in Rule 1113 - "Architectural Coatings" of the South Coast Air Quality Management District (SCAQMD), of the State of California, Amended February 5, 2016.

2. The VOC limits defined by SCAQMD are measured in grams per liter (g/L), less water and less exempt compounds.

3. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.

4. General: For specified building construction related applications, the allowable VOC content is as follows:

    a. Coatings

        1) Building Envelope Coatings 50

        2) Clear Wood Finish:

            a) Varnish 275

            b) Sanding Sealers 275

            c) Lacquer 275

        3) Concrete-Curing Compounds 100

        4) Dry Fog Coatings 50

        5) Floor Coatings 50

        6) Low-solids Coatings 120*

        7) Magnesite Cement Coatings 450

        8) Primers, Sealers and Undercoaters 100

        9) Shellac

            a) Clear 730

            b) Pigmented 550

        10) Stains 100

        11) Waterproofing Sealers 100

        12) Waterproofing Concrete/Masonry Sealers 100

        13) Wood Preservatives 350

*Note: VOC levels for Low-Solids coatings are measured in grams of VOC per liter of material, including water.

3.0 EXECUTION (NOT USED)

*****END OF SECTION 01 81 16*****

SECTION 01 81 19 - CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

1.0 GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for construction indoor air quality management.

1. The Owner has established that this Project shall prevent indoor air quality problems resulting from the construction process, to sustain long-term installer and occupant health and comfort.

2. Protect the ventilation system components during construction and cleanup of contaminated components after construction is complete.

3. Control sources of potential Indoor Air Quality (IAQ) pollutants by controlling selection of materials and processes used in project construction.

4. With regard to these goals the Contractor shall develop, for Owner and Design Professional's review, an IAQ Management Plan for this Project.

5. This specification addresses and requires the protection of the ventilation system components during construction and cleanup of contaminated components after construction is complete.

B. The SMACNA Guidelines recommend control measures in five areas:

1. HVAC protection

2. Source control

3. Pathway interruption

4. Housekeeping

5. Scheduling

C. Related Sections:

1. Section 01 8113, "Sustainable Design Requirements."

1.2 REFERENCES

A. Sheet Metal and Air Conditioner National Contractors Association (SMACNA) "IAQ Guidelines for Occupied Buildings under Construction", Second Edition, 2007, ANSI/SMACNA 008-2008 (Chapter 3): www.smacna.org

B. ANSI/ASHRAE 52.2-2007, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size”: www.ashrae.org

C. ASHRAE 52.2-2007: www.ashrae.com

D. CEN Standard 779-2002: cen.eu

1.3 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect about USGBC's LEED prerequisites and credits that are Contractor's responsibility, that depend on product selection or product qualities, or that depend on Contractor's procedures, until USGBC has made its determination on Project's LEED certification application.

B. Submit documentation to USGBC and respond to questions and requests from USGBC about its LEED prerequisites and credits that are Contractor's responsibility, that depend on product selection or product qualities, or that depend on Contractor's procedures, until USGBC has made its determination on Project's LEED certification application.

1. Document correspondence with USGBC as informational submittals.

1.4 SUBMITTALS

A. Construction IAQ Management Plan highlighting the five requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3, including a no-smoking policy.

B. Photographs (taken on a monthly basis) documenting construction IAQ management measures implemented during construction of each of the five SMACNA requirements.

1. These photographs need to document that all absorptive materials stored on-site and installed are covered and protected from any moisture damage on the construction site throughout construction. Label each photo with the date and a description of the SMACNA control measure being documented.

2. Comply with requirements of Section 01 3233 - PHOTOGRAPHIC DOCUMENTATION.

C. Cut sheets of filtration media used during construction and installed immediately prior to occupancy with MERV values highlighted.

D. Submit a letter from the Contractor describing building flush-out procedures including actual dates of building flush-out, hours of ventilation, ventilation rates, and indoor temperature and humidity levels.

E. Signed letter from Contractor stating that the use of tobacco products inside and within 25 feet of the building entrance was prohibited during construction.

F. Construction Indoor Air Quality Management Plan Submittal:

1. Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit a finalized Construction IAQ Management Plan.

2. The proposed Plan shall comply with requirements of the selected LEED criteria for the project.

3. The proposed Plan shall include, but not be limited to, the following:

a. Protection of ventilation system components during construction.

b. Cleaning and replacing contaminated ventilation system components after construction, including filtration media.

c. Temporary ventilation.

d. Protection of absorptive materials from moisture damage when stored on-site and after installation, including exterior wall rain protection.

e. Sequence of finish installation plan.

4. The following procedures shall be followed for the full duration of construction per WELL precondition A04 Construction Pollution Management:

a. All active areas of work shall be isolated from other occupied spaces by sealed doorways or windows or through the use of temporary barriers.

b. Walk-off mats at entryways shall be installed to reduce the transfer of dirt and pollutants.

c. Saws and other tools shall use dust guards or collectors to capture generated dust.

5. Coordinate Construction IAQ Management Plan with Owner's current IAQ management plans and procedures.

6. Comply with the requirements of LEED EQ prerequisite and credits.

2.0 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Environmental Tobacco Smoke Control: Prevent exposure of building systems to environmental tobacco smoke during construction. At a minimum, take the following measures:

1. Smoking shall be prohibited in all areas inside the building and within 25 feet of all entrances.

a. Do not allow smoking on rooftops or in construction trailers.

b. This prohibition includes electronic cigarettes.

2. Locate the project in a building that prohibits smoking by all occupants and users both inside the building and outside the building except in designated smoking areas located at least 25 feet (7.5 meters) from all entries, outdoor air intakes, and operable windows. Also prohibit smoking outside the property line in spaces used for business purposes.

a. If the requirement to prohibit smoking within 25 feet (7.5 meters) cannot be implemented because of code, provide documentation of these regulations.

b. Signage must be posted within 10 feet (3 meters) of all building entrances indicating the no-smoking policy.

B. Construction Indoor Air Quality Management Plan: During construction, comply with the following requirements:

1. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2-2007. Replace filtration media immediately prior to occupancy.

C. Indoor Air Quality Assessment: Comply with the following requirement:

1. Conduct IAQ testing for air contaminant levels in the building, after construction ends and before occupancy in accordance with LEEDv4 credit EQc Indoor Air Quality Assessment, Option 2. Air Testing.

2.2 IAQ MANAGEMENT PLAN

A. Develop a Draft Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows: (1) during construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3, (2) Protect stored on-site or installed absorptive materials from moisture damage, (3) conduct a building flush-out after construction ends and prior to occupancy, and 4) prohibit the use of tobacco products inside the building and within 25 feet of the building entrances during construction.

1. The SMACNA IAQ Guidelines for Occupied Buildings under Construction provides an overview of air pollution associated with construction, control measures, construction process management, quality control, communicating with occupants, and case studies. These guidelines can be accessed at www.smacna.org. Chapter 3 of the SMACNA Guidelines recommends Control Measures in five areas: HVAC protection, source control, pathway interruption, housekeeping, and scheduling. Review the applicability of each Control Measure and include those that apply in the Draft IAQ Management Plan.

a. HVAC Protection: Shut down the return side of the HVAC system whenever possible during heavy construction. If the system must remain operational during construction include the following strategies that apply:

1) If conditioning is required during construction, use supplementary HVAC units instead of permanently installed equipment if possible.

2) Seal all ductwork, registers, diffusers, and returns with plastic when stored on site or not in service. Seal unfinished runs of ductwork at the end of each day

3) Fit the return side of the HVAC system with temporary filters. These filters must have a minimum efficiency reporting value (MERV) of 13.

4) Isolate the return side of the HVAC system from the surrounding environment as much as possible (e.g., place all tiles for the ceiling plenum, repair all ducts and air handler leaks).

5) Damper off the return system in the heaviest work areas and seal the return system openings with plastic.

6) Upgrade the filter efficiency where major loading is expected to affect the operating HVAC system.

7) Clean permanent return air ductwork per National Air Duct Cleaning Association standards upon completion of all construction and finish installation work.

8) If permanently installed air handlers are used during construction, filtration media with a minimum MERV of 8, as determined by ASHRAE 52.2–2007, with errata (or equivalent filtration media class of F5 or higher, as defined by CEN Standard EN 779–2002, Particulate Air Filters for General Ventilation, Determination of the Filtration Performance), are installed at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media. Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer's recommendations.

9) Immediately before occupancy, replace all filtration media with the final design filtration media, installed in accordance with the manufacturer's recommendations.

b. Source Control: Keep sources of contaminants out of the building and have a plan to eliminate any that are introduced:

1) Use only low-emitting and low or no-VOC materials complying with LEEDv4.1 credit EQc Low-Emitting Materials (see Section 01 8116, Low Emitting Materials Restrictions).

2) Develop protocols for the use of any high-toxicity materials. Isolate areas where high-toxicity materials are being installed and use temporary ventilation for that area.

3) Prevent exhaust fumes (from idling vehicles, equipment, and fossil-fueled tools) from entering the building.

4) Prohibit the use of tobacco products inside the building and within 25 feet (7.5 meters) of the building entrance during construction.

5) Protect stored materials from moisture because absorbent materials exposed to moisture during construction can mold and degenerate long after installation. Store materials in dry conditions indoors, under cover, and off the ground or floor.

6) If materials are improperly exposed to moisture, replace the material and consider testing air quality before occupancy to make sure no mold contamination has occurred.

c. Pathway Interruption: Prevent contamination of clean spaces. Include the following strategies that apply:

1) Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.

2) Isolate areas of work to prevent contamination of other spaces, whether they are finished or not. Seal doorways, windows, or tent off areas as needed using temporary barriers, such as plastic separations. Provide walk-off mats at entryways to reduce introduced dirt and pollutants.

3) Use dust guards and collectors on saws and other tools.

4) Depressurize the work area to allow a differential between construction areas and clean areas. Exhaust to the outdoors using 100% outdoor air, if possible

d. Housekeeping: Reduce construction contamination in the building prior to occupancy through HVAC and regular space cleaning activities.

1) Maintain good job site housekeeping on a daily basis. Use vacuum cleaners with high-efficiency particulate filters and use sweeping compounds or wetting agents for dust control when sweeping

2) Store building materials in a weather tight, clean area prior to unpacking for installation.

3) Check for possible damage to the HVAC system and Building assemblies from high humidity.

4) Clean all coils, air filters, and fans before testing and balancing procedures are performed.

e. Scheduling: Specify construction sequencing to reduce absorption of VOCs by materials that act as sinks or contaminant sources. Complete application of wet and odor-emitting materials such as paints, sealants, and coatings before installing sink materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings are installed.

1) Consider after-hours or weekend work if practical.

2. Protect stored on-site or installed absorptive materials from exposure to moisture through precipitation, plumbing leaks, or condensation from the HVAC system to prevent microbial contamination.

a. Immediately remove from site and properly dispose of materials showing signs of mold and mildew, including materials with moisture stains.

2.3 FILTRATION MEDIA

A. Filtration Media: Comply with ASHRAE 52.2-2007 and provide MERV as required.

3.0 EXECUTION

3.1 CONSTRUCTION INDOOR AIR QUALITY PLAN IMPLEMENTATION

A. IAQ Manager: The Contractor shall designate an on-site person responsible for instructing workers and overseeing and documenting results of the Construction IAQ Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan to the jobsite foreman, each Subcontractor, the Owner and the Engineer.

C. Instruction: The Contractor shall provide on-site instruction of appropriate procedures and methods to be used by all parties at the appropriate stages of the Project.

D. Preconditioning: Allow products, which have odors and significant VOC emissions, to off-gas in a dry, well-ventilated space for sufficient period to dissipate odors and emissions prior to delivery to Project.

1. Remove containers and packaging from materials prior to conditioning to maximize off-gassing of VOCs.

2. Condition products in ventilated warehouses or other building.

E. Coordinate Construction IAQ Management Plan with final cleaning, per Section 01 7700 CLOSEOUT PROCEDURES.

F. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with Section 01 7700 and local laws and ordinances and Federal and local environmental and antipollution regulations and that will not void any LEED Sustainability requirements

3.2 INDOOR AIR QUALITY ASSESSMENT

A. As part of Indoor air quality management, one of the following requirements have to be met:

1. FLUSH-OUT. Before Occupancy install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4 267 140 liters of outdoor air per square meter) of gross floor area while maintaining an internal temperature of at least 60°F (15°C) and no higher than 80°F (27°C) and relative humidity no higher than 60%.

2. IAQ Testing: After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing using protocols consistent with the methods in the table below for all occupied spaces. Use current versions of ASTM standard methods, EPA compendium methods, or ISO methods, as indicated. Labs that conduct the test for chemical analysis of formaldehyde and VOCs must be accredited under ISO/IEQ 17025 for the test methods they use. Conduct all measurements before occupancy during normal occupied hours, with the building ventilation system started at the normal daily start time and operated at the minimum outdoor airflow rate for the occupied mode throughout the test. For each sampling point where the concentrations exceed the limit, take corrective action and retest for the noncompliant contaminants at the same sample points. Repeat until all requirements are met.

B. The following contaminants cannot exceed concentration levels listed below:

Contaminant			Maximum concentration	ASTM and U.S. EPA methods	ISO method
Particulates	**PM10** (for all buildings)		50 µg/m³ Healthcare only: 20 µg/m³	EPA Compendium Method IP-10	ISO 7708
	PM2.5 (for buildings in EPA nonattainment areas for PM2.5, or local equivalent)		15 µg/m³		
Ozone (for buildings in EPA nonattainment areas for Ozone, or local equivalent)			0.075 ppm	ASTM D5149 - 02	ISO 13964
Carbon monoxide (CO)			9 ppm; no more than 2 ppm above outdoor levels	EPA Compendium Method IP-3	ISO 4224
Total volatile organic compounds (TVOCs)			500 µg/m³ Healthcare only: 200 µg/m³	EPA TO-1, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Formaldehyde			27 ppb Healthcare only: 16.3 ppb	ASTM D5197, EPA TO-11, or EPA Compendium Method IP-6	ISO 16000-3
Target volatile organic compounds*	1	Acetaldehyde	140 µg/m³		
	2	Benzene	3 µg/m³	ASTM D5197; EPA TO-1, TO-17, or EPA Compendium Method IP-1	ISO 16000-3, ISO 16000-6
	3	Carbon disulfide	800 µg/m³		
	4	Carbon tetrachloride	40 µg/m³		
	5	Chlorobenzene	1000 µg/m³		
	6	Chloroform	300 µg/m³		
	7	Dichlorobenzene (1,4-)	800µg/m³		
	8	Dichloroethylene (1,1)	70 µg/m³		
	9	Dimethylformamide (N,N-)	80 µg/m³		
	10	Dioxane (1,4-)	3000 µg/m³		
	11	Epichlorohydrin	3 µg/m³		
	12	Ethylbenzene	2000 µg/m³		
	13	Ethylene glycol	400 µg/m³		
	14	Ethylene glycol monoethyl ether	70 µg/m³		
	15	Ethylene glycol monoethyl ether acetate	300 µg/m³		
	16	Ethylene glycol monomethyl ether	60 µg/m³		
	17	Ethylene glycol monomethyl ether acetate	90 µg/m³		
	19	Hexane (n-)	7000 µg/m³		
	20	Isophorone	2000 µg/m³		
	21	Isopropanol	7000 µg/m³		
	22	Methyl chloroform	1000 µg/m³		
	23	Methylene chloride	400 µg/m³		
	24	Methyl t-butyl ether	8000 µg/m³		
	25	Naphthalene	9 µg/m³		
	26	Phenol	200 µg/m³		
	27	Propylene glycol monomethyl ether	7000 µg/m³		
	28	Styrene	900 µg/m³		
	29	Tetrachloroethylene (Perchloroethylene)	35 µg/m³		
	30	Toluene	300 µg/m³		
	31	Trichloroethylene	600 µg/m³		
	32	Vinyl acetate	200 µg/m³		
	33-35	Xylenes, technical mixture (m-, o-, p-xylene combined)	700 µg/m³		

ppb = parts per billion; ppm = parts per million; µg/m³ = micrograms per cubic meter

C. Draft IAQ Management Plan Review Meeting: Once the Owner and Design Professional have reviewed the Draft IAQ Management Plan and prior to construction at the site, schedule and conduct a meeting to review the Draft IAQ Management Plan and discuss procedures, schedules and specific requirements for IAQ during the construction and pre-construction phases of the building. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance to the requirements. Record minutes of the meeting, identify all conclusions reached and matters requiring further resolution.

1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the IAQ management program, Design Professional, Owner and such additional personnel as the Design Professional or Owner deems appropriate.

D. Final IAQ Management Plan: Make any revisions to the Draft IAQ Management Plan agreed upon during the meeting identified above and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plan to the Owner and Design Professional for approval within 10 calendar days of the meeting.

*****END OF SECTION 01 81 19*****

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 “Building Enclosure Commissioning Requirements” 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 91 15 BUILDING ENCLOSURE COMMISSIONING REQUIREMENTS

1.0 GENERAL

1.1 SECTION INCLUDES

A. This section includes the commissioning requirements for the Building Enclosure systems.

1. The commissioning requirements for the Building Enclosure systems given in this section are entirely separate from, and in addition to, the General Commissioning Requirements for this project. The General Contractor (GC), Subcontractors, and Suppliers are required to participate in both commissioning processes as required and any supplemental General Commissioning requirements.

2. The Commissioning Agent and Building Enclosure Commissioning Agent will provide separate documentation for each commissioning process.

1.2 GENERAL DESCRIPTION

A. Building Enclosure Commissioning (BECx) is a systematic process of ensuring all building enclosure systems responsible for environmental separation perform interactively according to the Owner's Project Requirements and the Architect's Basis of Design. The BECx process is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify and document proper installation and performance of building enclosure materials and systems.

2. Provide Owner with functional building enclosure systems that meet the Owner's Project Requirements.

B. Commissioning does not take away from, or reduce responsibility of, system designers or installing contractors to provide a finished and fully functioning product.

C. This section shall in no way diminish the responsibility of Division 03, 04, 07, 08, and 09 Contractors, Subcontractors, and Suppliers in performing all aspects of work and testing as outlined in the Contract Documents. Any requirements outlined in this section are in addition to requirements outlined in Division 03, 04, 07, 08, and 09.

1.3 RELATED WORK AND DOCUMENTS

A. Specific building enclosure commissioning requirements are provided in this specification. The following specification sections are related to the commissioning work specified in this section:

1. General Commissioning Requirements: Refer to 019100

2. Basic Concrete Requirements: Refer to Division 03

3. Basic Masonry Requirements: Refer to Division 04

4. Basic Waterproofing, Sealants, Expansion Control, Metal Wall Panels, Roofing, Air Barrier and Insulation Requirements: Refer to Division 07

5. Basic Fenestrations Requirements: Refer to Division 08

6. Basic Finishing Requirements: Refer to Division 09

1.4 ABBREVIATIONS

A. The following are common abbreviations used in the Specifications (definitions are found further in this Section):

1. A/E - Architect and Design Engineers

2. BECA - Building Enclosure Commissioning Agent

3. CxA - Commissioning Agent - Refer to Section 019100

4. GC - General Contractor

5. CT - Commissioning Team

6. Cx - Commissioning

7. Cx Plan - Commissioning Plan

8. FPT - Functional Performance Test

9. OR - Owner's Representative

10. O&M - Operations & Maintenance

11. OPR - Owner’s Program Requirements

12. RFI - Request for Information

13. BETA - Building Enclosure Testing Agency

1.5 DEFINITIONS

A. Approval: Acceptance that a material or system has been properly installed and is functioning in tested modes according to the Contract Documents.

B. Architect/Engineer (A/E): Prime consultant (architect) and sub-consultants who comprise the design team, generally the Architect of Record and any Design Sub-consultants.

C. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to meet the OPR.

D. Building Enclosure Commissioning Agent (BECA): Contracted through the Owner. The BECA directs and coordinates day-to-day building enclosure commissioning activities independently from CxA and reports directly to the Owner.

E. Commissioning Agent (CxA): Contracted to Owner. CxA directs and coordinates day-to-day commissioning activities excluding BECx activities. CxA reports directly to Owner.

F. Commissioning Plan: Overall plan developed after bidding that provides structure, schedule, and coordination planning for commissioning process. The BECx plan will be provided separately from other Cx plans.

G. Contract Documents: Documents binding on parties involved in construction of this project (drawings, specifications, change orders, amendments, contracts, etc.).

H. Deficiency: Condition of a building enclosure material or system that is not in compliance with Contract Documents, i.e. does not perform properly or is not complying with design intent.

I. Functional Performance Test (FPT): Test of installed (either mock-up or field) performance of building enclosure materials and systems. Systems are tested under various simulated environmental conditions.

J. Owner's Project Requirements (OPR): A written document that details the functional requirements of a project and the usage and operational expectations. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

K. Simulated Condition: Condition created for testing component or system (e.g., applying pressure differential across the building enclosure concurrent with water spray to simulate a wind-driven rain).

L. Specifications: Construction specifications of Contract Documents.

M. Mock-up: The activities where systems or materials are initially constructed and tested. Mock-ups are to be free standing and approved prior to commencing full-scale construction.

N. Benchmark installation: the first completed area for each type of installation that is inspected visually and technically, and approved by the a/e and façade consultant. It constitutes a benchmark against which all future work is assessed.

O. Subcontractor: Contractors of GC, and their Subcontractors, who provide and install building enclosure components and systems.

1.6 COORDINATION

A. Commissioning Team: Members of the Commissioning Team (CT) will consist of:

1. Commissioning Agent (CxA)

2. Building Enclosure Commissioning Agent (BECA)

3. Building Enclosure Testing Agent (BETA)

4. Cornell Owner's Representative(s) (OR)

5. General Contractor (GC)

6. Architect and Design Engineers (A/E)

7. Building Enclosure Subcontractors

B. Management: Owner will contract services of the BECA directly. The BECA will direct and coordinate commissioning activities and report to the OR. All members of the Commissioning Team shall cooperate to fulfill contracted responsibilities and objectives of the Contract Documents.

C. Scheduling:

1. BECA will work with commissioning team to establish required commissioning activities to incorporate in preliminary commissioning schedule. The GC will integrate commissioning activities into master construction schedule. Necessary notifications are to be made in a timely manner in order to expedite commissioning.

1.7 SUBMITTALS

A. A/E or General Contractor shall provide BECA with documentation required for commissioning work. At minimum, documentation shall include: General Commissioning Requirements and performance data and any performance test procedures.

B. BECA shall review submittals concurrent with the A/E for conformance as it relates to Building Commissioning.

2.0 PRODUCTS – NOT USED

3.0 EXECUTION

3.1 SYSTEMS TO BE COMMISSIONED

A. Building Enclosure

1. Below Grade Systems, Roofing Systems, Opaque Wall/Cladding Systems, Air Barrier Systems, Fenestration Systems responsible for providing the following functions:

   a. Air barrier

   b. Vapor barrier

   c. Insulation

   d. Waterproofing

3.2 RESPONSIBILITIES OF COMMISSIONING TEAM DURING CONSTRUCTION

A. Architect/Engineer (A/E)

1. Document design intent of systems.

2. Review and incorporate building enclosure commissioning specification and functional performance test specification into the construction documents.

3. Provide construction documents electronically.

4. Review BECA comments on construction document and shop drawings.

5. Assist in dispute resolution regarding building enclosure items.

6. Review BECA reports.

B. Building Enclosure Commissioning Agent (BECA)

1. Review and comment on the Design Intent and Basis of Design for the project, and create the Owner's Project Requirements (OPR) document for the building enclosure after the initial kick-off meeting with the project team.

2. Develop and submit the Building Envelope Commissioning Plan, coordinating the Plan with the CxA and the rest of the team.

3. Develop Enclosure Commissioning specifications and requirements for Functional Performance Testing for building envelope systems for incorporation into the project documents.

4. Develop and maintain an Enclosure Design Issues Log, documenting identified issues, responses, and resolution.

5. Attend regularly scheduled meetings/conference calls/web-based interfaces at milestones appropriate for the complexity of the project and to maintain schedule milestones.

6. Provide technical reviews of the 100% Construction Documents.

7. Review all exterior envelope subcontractor proposals, evaluate qualifications and exclusions, and make recommendations.

8. Conduct a BECx kick-off meeting with the Owner, Design Team, Construction Manager, and Subcontractors, including preparing meeting minutes.

9. Review the construction sequencing and verify the material assembly and compatibility through shop drawings and project submittals. Review of the shop drawings and submittals pertinent to the building enclosure will be conducted prior to or in conjunction with the review by the Design Team. The Design Team will have the ability to incorporate review comments for approval.

10. Review and comment on all enclosure related RFIs, bulletins, and change order proposals.

11. Review proposed substitutions and value engineering.

12. Review and comment on construction scheduling and sequencing.

13. Lead a pre-installation conference for building enclosure trades and issue meeting minutes to the project team. During the meeting, review trade sequencing, ownership, constructability, and compatibility of work.

14. Review and document the construction of an initial benchmark installation against the design documents, shop drawings, recommended manufacturer's installation instructions, and the industry accepted standard of care. All testing will be witnessed and documented, and assistance provided for diagnosing performance problems. At the completion of the initial benchmark installation, notes, photos, sketches, manufacturer's details, project information and design changes will be assembled into an initial benchmark installation manual that will be distributed to the project team. This manual is intended to define the standard of care demonstrated in the initial benchmark installation for use on the remainder of the project.

15. Verify and document field QA/QC tasks, perform weekly inspections, and track the progress of resolving on-going deficiency list items. During QA inspections, review the exterior enclosure for conformance to the design documents, shop drawings, recommended manufacturer's installation instructions, and the industry accepted standard of care. Reporting system shall individually track each condition observed in the field with the intent of completing this project with no unaddressed items. Verify that the enclosure checklists are being utilized and tracked.

16. Update the BECx plan throughout the construction phase, as required. Integrate RFIs and change orders into the BECx plan and coordinate BECx plan items with relevant parties.

17. Observe and witness functional performance testing and retesting by others. Prepare and distribute written and illustrated reports to the project team including concerns and recommendations.

18. Prepare a draft and final commissioning report of all work and final acceptance.

19. Review as-built drawings and O&M manuals.

20. Visit the site approximately 11 months post occupancy to review the performance and observe the condition of the exterior building elements. Upon completion of this site visit, update the final commissioning report.

C. General Contractor (GC)

1. Attend all commissioning meetings.

2. Incorporate commissioning activities into the construction schedule.

3. Periodically update commissioning activities in the construction schedule.

4. Facilitate cooperation of Subcontractors in commissioning work.

5. Submit copies of initial and final A/E approved submittals for commissioned system equipment to BECA for review.

6. Review BECA submittal comments

7. Verify building enclosure materials and assemblies are ready for functional testing.

8. Submit maintenance logs of all interim maintenance or repair tasks performed by Subcontractors.

9. Ensure resolution of non-compliance and deficiencies in construction or test results. Obtain written documentation of completion from the appropriate Subcontractors.

10. Provide letters of compatibility for adjacent building enclosure materials and assemblies.

11. Facilitate all repairs and retesting of failed condition and pay for all associated costs.

12. Provide all warrantee information to BECA.

D. Subcontractors/Vendors

1. Review Commissioning Plan and FPT specification.

2. Attend commissioning kick-off meeting and other commissioning team meetings.

3. Notify GC and BECA of work completion.

4. Attend all required material and systems testing.

5. Execute all periodic maintenance or repairs required on started systems from initial benchmark installation to final acceptance by Owner to prevent material warranties from being voided.

6. Ensure installation work is complete, is in compliance with Contract Documents, and is ready for Functional Performance Testing. Notify GC that equipment and systems are ready for Functional Performance Testing. FPT test results will be documented by BECA.

7. Provide all warranty information to GC.

E. Building Enclosure Testing Agency (BETA)

1. Attend commissioning kick-off meeting and other commissioning team meetings.

2. Provide on-site technician and equipment to complete benchmark and field Functional Performance Testing.

3. Prepare and submit reports at the conclusion of all testing.

4. Perform retesting and prepare corresponding reports.

3.3 REPORTING

A. BECA will provide status reports to GC, A/E, and Owner as needed.

B. BECA shall submit non-compliance and deficiency reports to GC, A/E, and Owner as needed.

C. BECA shall provide a final summary report to Owner.

3.4 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation

1. BECA will witness and document results of FPT.

B. Non-Conformance

1. BECA will record results of functional testing. Deficiency or non-conformance issues will be noted and reported to GC, CxA, and Owner.

2. Corrections of minor deficiencies identified may be made during tests at discretion of BECA. In such cases, deficiency and resolution will be documented.

3. Every effort will be made to expedite testing and minimize unnecessary delays, while not compromising integrity of tests. BECA shall not overlook deficient work or loosen acceptance criteria to satisfy scheduling or cost issues unless directed to do so by the Owner.

4. Deficiencies are handled in the following manner:

   a. When there is no dispute on deficiency and Subcontractor accepts responsibility for remedial action:

      - BECA documents deficiency and Subcontractors response and intentions and they go on to another test or installation. BECA submits deficiency report to GC, CxA, and Owner. Copy is provided to Subcontractor by GC. Subcontractor corrects deficiency and certifies that material or assembly is ready to be retested. GC informs CT of retesting schedule.
      - GC reschedules test with BECA and BETA.

   b. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

      - BECA documents deficiency and Contractor's response. BECA submits deficiency report to GC, CxA, and Owner. A copy is provided to Subcontractor by GC.
      - GC facilitates resolution of deficiency. Other parties are brought into discussions as needed. Final interpretive authority is with A/E. Final acceptance authority is with the Owner.
      - GC documents resolution process.
      - Once interpretation and resolution has been decided, appropriate party corrects deficiency, GC reschedules test, and test is repeated until satisfactory performance is achieved.

C. Cost of Retesting

1. Costs for all retesting will be the full responsibility of the GC and Subcontractors. These costs include all access, equipment, labor, and materials required to complete the retesting.

3.5 COMMISSIONING DOCUMENTATION

A. Final Report Details

1. Final commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, and general description of testing and verification methods. Report will contain evaluation regarding:

   a. Conformance to specifications and design intent

   b. Material/system installation

   c. Functional performance

2. All outstanding non-compliance items will be specifically listed.

3. Recommendations for improvement to system or operations, future actions, etc. will also be listed.

*****END OF SECTION 01 91 15*****

TECHNICAL SPECIFICATIONS

FOR

BEEBE HALL CU MAKER HUB RENOVATIONS

SEPTEMBER 14, 2026

CORNELL UNIVERSITY
ITHACA, NEW YORK

SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes, excluding removal of hazardous materials and toxic substances.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
D. Section 01 8113 - Sustainable Design Requirements
E. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove items as indicated in demolition plans.
B. Remove other items indicated, for salvage, relocation, and recycling.
C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. 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. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   6. 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.
   7. 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. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

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. Remove existing work as indicated and required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services including, but not limited to, HVAC, 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. Verify that abandoned services serve only abandoned facilities before removal.
   4. 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.

D. Protect existing work to remain.
   1. Repair adjacent construction and finishes damaged during removal work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 02 8313 - LEAD-SAFE WORK PRACTICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Quality assurance requirements including personnel training.
B. Regulatory Requirements
C. Work practices.
D. Requirements for transport and disposal of lead waste materials by legal and appropriate means.

1.02 RELATED SECTIONS

A. 01 5000 - Temporary Facilities and Controls.

1.03 REFERENCE STANDARDS

A. United States Environmental Protection Agency (USEPA)
   1. 40 CFR Part 260 - Hazardous Waste Management System: General
   2. 40 CFR Part 261 - Identification and Listing of Hazardous Waste.
   3. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste.
   4. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste.
   5. 40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.
   6. 40 CFR Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.
   7. 40 CFR Part 266 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.
   8. 40 CFR Part 268 - Land Disposal Restrictions.
   9. 40 CFR Part 270 - EPA Administered Permit Programs: The Hazardous Waste Permit Program.
   10. 40 CFR Part 745, Subpart L - Lead-Based Paint Activities.
   11. 40 CFR Part 745, Subpart E - Residential Property Renovation.
B. United States Department of Transportation (DOT)
   1. 49 CFR 171 - General Information, Regulations, and Definitions.
   2. 49 CFR 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.
   3. 49 CFR 173 - Shippers - General Requirements for Shipments and Packaging.
C. New York State Department of Environmental Conservation (DEC)
   1. 6 NYCRR 360 - Solid Waste Management Facilities.
   2. 6 NYCRR 364 - Waste Transporter Permits.
   3. 6 NYCRR 370 - Hazardous Waste Management System: General.
   4. 6 NYCRR 371 - Identification and Listing of Hazardous Wastes.
   5. 6 NYCRR 372 - Hazardous Waste Manifest and Related Standards for Generators, Transporters and Facilities.
   6. 6 NYCRR 373 - Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements.
   7. 6 NYCRR 376 - Land Disposal Restrictions.
D. Occupation Safety and Health Administration (OSHA)
   1. OSH29 CFR 1926.62 - Construction Standard for Lead

1.04 SCOPE OF WORK

A. The scope of work for lead abatement/safe work practices includes the management of lead and or lead based painted surfaces and/or components known or presumed to contain lead in concentrations equal to or in excess of 1.0 milligrams/per square centimeter or 0.5% by weight during Renovation activities in target housing and child occupied facilities as detailed within United States Environmental Protection Agency standard for Residential Property Renovation, cited as 40 CFR Part 745, Subpart E; and
B. In all instances including those where building components are known or suspected to contain lead in concentrations below 0.5% by weight, and construction, alteration and/or repair work is performed in areas of the building/exterior which are not considered target housing and/or child occupied facilities lead safe work practices shall include all provisions as set forth under Occupational Safety and Health Administration (OSHA) regulation for Occupational Exposure to Lead, cited as 29 CFR 1926.62.

1.05 DEFINITIONS

A. Child-occupied facility: A building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under 6 years of age, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day care centers, preschools and kindergarten classrooms. Child-occupied facilities may be located in target housing or in public or commercial buildings. With respect to common areas in public or commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only those common areas that are routinely used by children under age 6, such as restrooms and cafeterias. Common areas that children under age 6 only pass through, such as hallways, stairways, and garages are not included. In addition, with respect to exteriors of public or commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only the exterior sides of the building that are immediately adjacent to the child-occupied facility or the common areas routinely used by children under age 6.

B. Cleaning verification card: A card developed and distributed, or otherwise approved, by EPA for the purpose of determining, through comparison of wet and dry disposable cleaning cloths with the card, whether post-renovation cleaning has been properly completed.

C. Lead: metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

D. Lead-Based Paint (LBP) : Paint or other surface coatings that contain lead equal to or in excess of 1.0 mg/cm2 or 0.5% by weight.

E. Minor repair and maintenance activities are activities, including minor heating, ventilation or air conditioning work, electrical work, and plumbing, that disrupt 6 square feet or less of painted surface per room for interior activities or 20 square feet or less of painted surface for exterior activities where none of the work practices prohibited or restricted by §745.85(a)(3) are used and where the work does not involve window replacement or demolition of painted surface areas. When removing painted components, or portions of painted components, the entire surface area removed is the amount of painted surface disturbed. Jobs, other than emergency renovations, performed in the same room within the same 30 days must be considered the same job for the purpose of determining whether the job is a minor repair and maintenance activity.

F. Pamphlet: The EPA pamphlet titled Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools developed under section 406(a) of TSCA for use in complying with section 406(b) of TSCA, or any State or Tribal pamphlet approved by EPA pursuant to 40 CFR 745.326 that is developed for the same purpose.

G. Renovation: The modification of any existing structure, or portion thereof, that results in the disturbance of painted surfaces, unless that activity is performed as part of an abatement as defined by this part (40 CFR 745.223). The term renovation includes (but is not limited to): The removal, modification or repair of painted surfaces or painted components (e.g., modification of painted doors, surface restoration, window repair, surface preparation activity (such as sanding, scraping, or other such activities that may generate paint dust)); the removal of building components (e.g., walls, ceilings, plumbing, windows); weatherization projects (e.g., cutting holes in painted surfaces to install blown-in insulation or to gain access to attics, planing thresholds to install weather-stripping), and interim controls that disturb painted surfaces. A renovation performed for the purpose of converting a building, or part of a building, into target housing or a child-occupied facility is a renovation under this subpart. The term renovation does not include minor repair and maintenance activities.

H. Renovator: An individual who either performs or directs workers who perform renovations. A certified renovator is a renovator who has successfully completed a renovator course accredited by EPA or an EPA-authorized State or Tribal program.

I. Work area: The area that the certified renovator establishes to contain the dust and debris generated by a renovation.

1.06 SYSTEM DESCRIPTION

A. Lead-Safe Work Practices: Lead-Safe Work Practices provide for disturbance of lead, including removal and disposal of: lead-based paint; lead containing dust; and lead contaminated soil in accordance with all applicable codes, regulations, standards, laws and ordinances and provides general overview of anticipated requirements and conditions necessary to meet regulatory requirements and specific conditions of this Project. Failure to expressly refer to applicable code, regulation, standard, law and ordinance within Contract Documents does not imply that applicable regulatory requirements are not applicable to this Project.

1. Presumed Lead Containing Surfaces: Surfaces for which there is no analytical data, and are suspected to contain lead based on age, use or other factors, should be presumed to contain lead at a level above 0.5% until a negative determination can be made through recognized industry standards.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Quality Control Submittals

1. Submit following items prior to beginning lead related activities at Site:

a. Valid Waste Transporter Permit, issued by New York State Department of Environmental Conservation.
b. Written communication from designated treatment, storage or disposal facility that it:
1) Is authorized to receive and dispose of waste products generated by this Project;
2) Has capacity to receive and dispose of waste products generated by this Project and;
3) Will provide or assure that ultimate disposal method indicated on manifest for particular hazardous waste(s) will be followed.
c. Instruction regarding requirements for distribution of waste manifest as completed at time of shipment.
d. Emergency Contact List.
e. A written acknowledgment that the owner has received the EPA pamphlet titled Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools. OR provide a certificate of mailing at least 7 days prior to the renovation.
f. A statement describing the steps performed to notify all occupants, parents and guardians of the intended renovation activities and to provide the pamphlet.

2. Submit following items during course of lead related activities at Site:
a. Employee Training and Certification Documentation: Provide Owner with Valid Training and Certification documentation for all renovators in accordance with 40 CFR Part 745.90(a) prior to beginning work.

3. Submit following items after completion of lead related activities at Site:
a. Daily Logs.
b. Sign In Sheets.
c. Documentation of Hazardous Waste Determination, consisting of Toxicity Characteristic Leachate Procedure sample analysis and documentation that identifies the material(s) sampled.
d. For waste that is known or determined to be hazardous, New York State Uniform Hazardous Waste Manifest or manifest as required by the state where the waste is disposed.
e. Trip Tickets for all other waste.

4. Certificates - Submit certification that indicates compliance with requirements specified in Quality Assurance below.

1.08 QUALITY ASSURANCE

A. Qualifications
1. Contractor
a. Personnel Certification Requirements
1) Lead Personnel: Received “Lead-Safe Work Practices” training approved by United States Department of Housing and Urban Development (HUD) within the last 12 months.
2) Lead Supervisory Personnel: Maintain current USEPA certification as a lead-based paint abatement supervisor as per 40 CFR 763.
b. Personnel Training Requirements: In addition to the training requirements for USEPA certification, all supervisory or Lead-Safe Work Practice personnel, including any personnel entering lead activity areas shall have training as required by 29 CFR 1926.62

2. Owner’s Sampling / Monitoring Firm: Independent of Contractor and possessing current USEPA certification to perform lead-based paint activities. May not be applicable to the project.
a. Personnel Certification
1) Monitoring: Possess current USEPA certification, as per 40 CFR 745, subpart L, as either “Risk Assessor” or “Inspector”.
2) Final Inspection or Clearance Testing Possess current USEPA certifications, as per 40 CFR 745, subpart L, as either “Risk Assessor” or “Inspector”.

3. Lead Analysis Laboratories:
a. Maintain current National Lead Laboratory Accreditation Program (NLLAP) accreditation.
b. Maintain current New York State Environmental Laboratory Approval Program (ELAP) accreditation in each method of analysis used.
c. Use most recent version of specified test method.
d. Analyze samples for waste characterization using:
1) Toxicity Characteristic Leachate Procedure - EPA Method 1311 and an acceptable, EPA recognized analysis method.
e. Analyze air samples for lead for total lead (if required) using an acceptable, EPA recognized analysis method
f. Analyze wipe samples, paint chip samples and soil samples using an acceptable, EPA recognized analysis method

B. Regulatory Requirements
1. Hazardous Waste Generator Status: Owner is “Conditionally Exempt Small Quantity Generator” as defined by 6 NYCRR 371 and 40CFR 260. Schedule removal, on-site storage, and transport as required to maintain Owner’s status as “Conditionally Exempt Small Quantity Generator”.

C. Recordkeeping and reporting requirements. Firms performing renovations must retain and, if requested, make available to EPA all records necessary to demonstrate compliance with this subpart for a period of 3 years following completion of the renovation. This 3-year retention requirement does not supersede longer obligations required by other provisions for retaining the same documentation, including any applicable State or Tribal laws or regulations.

1. Records that must be retained pursuant to paragraph (a) of this section shall include (where applicable):
   a. Reports certifying that a determination had been made by an inspector (certified pursuant to either Federal regulations at §745.226 or an EPA-authorized State or Tribal certification program) that lead-based paint is not present on the components affected by the renovation, as described in §745.82(b)(1).
   b. Signed and dated acknowledgments of receipt as described in §745.84(a)(1)(i), (a)(2)(i), (b)(1)(i), (c)(1)(i)(A), and (c)(1)(ii)(A).
   c. Certifications of attempted delivery as described in §745.84(a)(2)(i) and (c)(1)(ii)(A).
   d. Certificates of mailing as described in §745.84(a)(1)(ii), (a)(2)(ii), (b)(1)(ii), (c)(1)(i)(B), and (c)(1)(ii)(B).
   e. Records of notification activities performed regarding common area renovations, as described in §745.84(b)(3) and (b)(4), and renovations in child-occupied facilities, as described in §745.84(c)(2).
   f. Any signed and dated statements received from owner-occupants documenting that the requirements of §745.85 do not apply. These statements must include a declaration that the renovation will occur in the owner's residence, a declaration that no children under age 6 reside there, a declaration that no pregnant woman resides there, a declaration that the housing is not a child-occupied facility, the address of the unit undergoing renovation, the owner's name, an acknowledgment by the owner that the work practices to be used during the renovation will not necessarily include all of the lead-safe work practices contained in EPA's renovation, repair, and painting rule, the signature of the owner, and the date of signature. These statements must be written in the same language as the text of the renovation contract, if any.
   g. Documentation of compliance with the requirements of §745.85, including documentation that a certified renovator was assigned to the project, that the certified renovator provided on-the-job training for workers used on the project, that the certified renovator performed or directed workers who performed all of the tasks described in §745.85(a), and that the certified renovator performed the post-renovation cleaning verification described in §745.85(b). If the renovation firm was unable to comply with all of the requirements of this rule due to an emergency as defined in §745.82, the firm must document the nature of the emergency and the provisions of the rule that were not followed. This documentation must include a copy of the certified renovator's training certificate, and a certification by the certified renovator assigned to the project that:
   h. Training was provided to workers (topics must be identified for each worker).
   i. Warning signs were posted at the entrances to the work area.
   j. If test kits were used, that the specified brand of kits was used at the specified locations and that the results were as specified.
   k. The work area was contained by:
      1) Removing or covering all objects in the work area (interiors).
      2) Closing and covering all HVAC ducts in the work area (interiors).
      3) Closing all windows in the work area (interiors) or closing all windows in and within 20 feet of the work area (exteriors).
      4) Closing and sealing all doors in the work area (interiors) or closing and sealing all doors in and within 20 feet of the work area (exteriors).
      5) Covering doors in the work area that were being used to allow passage but prevent spread of dust.
      6) Covering the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater (interiors) or covering the ground with plastic sheeting or other disposable impermeable material anchored to the building extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering, weighted down by heavy objects (exteriors).
      7) Installing (if necessary) vertical containment to prevent migration of dust and debris to adjacent property (exteriors).
   l. Waste was contained on-site and while being transported off-site.
   m. The work area was properly cleaned after the renovation by:
   n. Picking up all chips and debris, misting protective sheeting, folding it dirty side inward, and taping it for removal.
   o. Cleaning the work area surfaces and objects using a HEPA vacuum and/or wet cloths or mops (interiors).
   p. The certified renovator performed the post-renovation cleaning verification (the results of which must be briefly described, including the number of wet and dry cloths used).
   q. When test kits are used, the renovation firm must, within 30 days of the completion of the renovation, provide identifying information as to the manufacturer and model of the test kits used, a description of the components that were tested including their locations, and the test kit results to the person who contracted for the renovation.
   r. If dust clearance sampling is performed in lieu of cleaning verification as permitted by §745.85(c), the renovation firm must provide, within 30 days of the completion of the renovation, a copy of the dust sampling report to the person who contracted for the renovation.

1.09 PROJECT/SITE CONDITIONS

A. Emergency Contact List: Prepare emergency contact list providing means to contact applicable individuals and agencies in event of emergency at any time of day or night and including at least the following individuals and agencies:
   1. Contractor Personnel
      a. Project manager
      b. Project supervisor
      c. Sampling Organization
         1) On Site Sampling Technician
      d. Owner
      e. Local police department
      f. Local fire department
      g. Local hospital and ambulance service

B. Restrict access to all work areas. Immediately report any access by unauthorized individuals to Owner and/or Owner's representative.

1.10 SEQUENCING AND SCHEDULING

A. Completion: Complete Lead related work in accordance with Construction Schedule requirements specified in SECTION 01015 - Project Schedule with each phase considered distinct and separate for purpose of schedule and substantial completion.
   1. Substantial Completion of phase occurs when:
      a. All components of phase have passed visual inspection by Supervisor; and
      b. Satisfactory clearance criteria are achieved for each portion of phase; and
      c. All containment barriers have been removed; and
      d. Areas are returned to Owner.
   2. If Contractor fails to achieve substantial completion within specified schedule requirements, all costs associated with extension of schedule, including (but not limited to) cost of Architect's time and expenses, sampling costs, monitoring costs, direct costs incurred by Owner, and costs to accelerate sample analysis deducted from Final Payment.

B. Restrictions on Working Hours: Schedule work only during regular working hours approved by Owner prior to beginning lead related work. Do not use overtime or multiple shifts with "overtime" defined as any time in excess of 8 hours in single day, work on weekends, or work on holidays.

C. Changes in Working Hours: Advise Owner of any changes in hours or days when lead activities will be conducted at Site at least 24 hours prior to change. Contractor retains all liability resulting from Contractor failure to make required notification.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Respirators: Provide respirators approved as acceptable for protection by National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CFR Part 11.
   1. Supply and use respirators as required in accordance with 29 CFR 1910.134 and 29 CFR1926.62.
   2. Provide respirators, filters and ancillary supplies as required for employees and authorized visitors.
   3. Account for hazards other than lead in respirator selection.

B. Protective Clothing: Provide disposable protective clothing complying with requirements of 29 CFR 1926.62 that is disposed of after one use. Provide disposable clothing as required for employees and authorized visitors.

C. Lead Related Construction Facilities and Controls:
   1. Polyethylene sheeting (plastic sheeting)- 6-mil thickness, sized to minimize seams.
   2. Tape and/or adhesive spray capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water;
   3. Polyethylene waste disposal bags - 6-mil thickness with preprinted labels.
   4. HEPA filtered negative pressure equipment.
   5. HEPA filtered vacuums.
   6. Water filtration, 3 stage with final filtration to at least 5 microns.
   7. Barrier tape.
   8. Warning signs.
   9. Hygiene facilities as required by 29 CFR 1926.62 including showers, cleansing agents and disposable towers.
   10. Lead specific detergent similar to:
      a. "Ledizolv Detergent" by LSV, Inc., New York, New York.

b. "Sentinel 805 EnviroWash" by Sentinel, Minneapolis, Minnesota.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions (by Contractor): Examine conditions under which lead related work is to be performed and notify Owner in writing of any conditions detrimental to proper and timely performance. Do not proceed with lead related work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

3.02 PREPARATION

A. Notification
   1. While the renovation is ongoing, post informational signs describing the general nature and locations of the renovation and the anticipated completion date. These signs must be posted in areas where they can be seen by the parents or guardians of the children frequenting the child-occupied facility. The signs must be accompanied by a posted copy of the pamphlet or information on how interested parents or guardians can review a copy of the pamphlet or obtain a copy from the renovation firm at no cost to the parents or guardians.
   2. Post signs clearly defining the work areas and warning occupants and other persons not involved in renovation activities to remain outside of the work areas. These signs must be posted before beginning the renovation and must remain in place and readable until the renovation and the post-renovation cleaning verification have been completed.

B. Protection
   1. Provide personal protective equipment as required by 29 CFR 1926.62 at no cost to employees or authorized visitors.
   2. Institute respirator program in accordance with 29 CFR 1926.62 and 29 CFR 1910.134 (b), (d), (e) and (f)
   3. Use protective clothing and respirators whenever lead is being disturbed, abated, cleaned up, and containerized or stored in vehicle or container used to transport waste to landfill in accordance with applicable regulations.
   4. Institute medical surveillance program in accordance with 29 CFR 1926.62 for all employees performing or supervising lead handling work, entering work area containment, or using respirator.

C. Prior to all other preparation activities, construct wash station or decontamination facilities as required by applicable regulations adjacent to lead work area.

D. Before beginning the renovation, the firm must isolate the work area so that no dust or debris leaves the work area while the renovation is being performed. In addition, the firm must maintain the integrity of the containment by ensuring that any plastic or other impermeable materials are not torn or displaced, and taking any other steps necessary to ensure that no dust or debris leaves the work area while the renovation is being performed. The firm must also ensure that containment is installed in such a manner that it does not interfere with occupant and worker egress in an emergency.

E. Exterior renovations. For all exterior renovations, the firm conducting the work shall:
   1. Close all doors and windows within 20 feet of the renovation. On multi-story buildings, close all doors and windows within 20 feet of the renovation on the same floor as the renovation, and close all doors and windows on all floors below that are the same horizontal distance from the renovation.
   2. Ensure that doors within the work area that will be used while the job is being performed are covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.
   3. Cover the ground with plastic sheeting or other disposable impermeable material extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering.
   4. In certain situations, the renovation firm must take extra precautions in containing the work area to ensure that dust and debris from the renovation does not contaminate other buildings or other areas of the property or migrate to adjacent properties.

F. Interior renovations. For all interior renovations, the firm conducting the work shall:
   1. Remove all objects from the work area, including furniture, rugs, and window coverings, or cover them with plastic sheeting or other impermeable material with all seams and edges taped or otherwise sealed.
   2. Close and cover all ducts opening in the work area with taped-down plastic sheeting or other impermeable material.
   3. Close windows and doors in the work area. Doors must be covered with plastic sheeting or other impermeable material. Doors used as an entrance to the work area must be covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.
   4. Cover the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater.
   5. Use precautions to ensure that all personnel, tools, and other items, including the exteriors of containers of waste, are free of dust and debris before leaving the work area.

6. The firm must clean all objects and surfaces in the work area and within 2 feet of the work area in the following manner, cleaning from higher to lower:
7. Clean walls starting at the ceiling and working down to the floor by either vacuuming with a HEPA vacuum or wiping with a damp cloth.
8. Thoroughly vacuum all remaining surfaces and objects in the work area, including furniture and fixtures, with a HEPA vacuum. The HEPA vacuum must be equipped with a beater bar when vacuuming carpets and rugs.
9. Wipe all remaining surfaces and objects in the work area, except for carpeted or upholstered surfaces, with a damp cloth. Mop uncarpeted floors thoroughly, using a mopping method that keeps the wash water separate from the rinse water, such as the 2-bucket mopping method, or using a wet mopping system.

G. Do not begin lead disturbance or removal activities until all preparation work, including installation of wash stations or decontamination enclosure systems and any required engineering controls (ex. negative air pressure equipment, etc.) has been completed as required by applicable regulations.

3.03 LEAD WORK PROCEDURES

A. Exterior Lead Work Constraints: Do not proceed with lead activities if wind speeds are greater than 20 miles per hour. Stop lead activities and proceed with cleanup activities before rain begins.

B. Unacceptable Removal Methods
1. Open flame burning or torching (includes propane-fueled heat grids).
2. Machine sanding, grinding, power planning, needle gun without HEPA local vacuum exhaust tool.
3. Hydroblasting or high-pressure wash.
4. Abrasive blasting or sandblasting without HEPA vacuum exhaust tool.
5. Heat guns operating above 1,100 deg. F.
6. Methylene chloride paint removal products.
7. Dry scraping.

C. Acceptable Removal Methods:
1. Component Removal
   a. Mist all disturbed paint and dust and maintain in moist condition.
   b. Entirely remove indicated components.
   c. Wet scrape residual paint from adjacent unpainted surfaces. Do not damage adjacent surfaces;
   d. Collect all paint chips, dust and debris and seal in 6 mil plastic bags.
   e. Seal removed building components in 6 mil plastic sheeting or 6 mil plastic bags.
2. Heat Gun Removal (operating at less than 1,100 deg. F)
   a. Provide fire extinguishers in lead work area, and ensure adequate electrical power is available.
   b. Use in limited areas only.
   c. Do not gouge or abrade substrate.
3. Wet Scraping
   a. Apply adequate water to moisten surface completely; avoid large amounts of water on floor or ground.
   b. Do not moisten areas near electrical circuits.
   c. Use spray bottles or wet sponge attached to scraper.
4. Offsite Stripping
   a. Apply paint removers in accordance with manufacturer's recommendations.
   b. Test paint remover in inconspicuous location approved by Architect to avoid damage to substrate.
   c. Identify building component to ensure reinstallation in same location.
   d. Mist all paint and dust disturbed and maintain in moist condition.
   e. Wet scrape residual paint from adjacent unpainted surfaces. Do not damage adjacent surfaces.
   f. Collect all paint chips, dust and debris and seal in 6 mil plastic bags. Seal removed building components in plastic sheeting. Inform offsite paint remover regarding presence of lead-based paint before shipping;
   g. Do not reinstall components until removal of residual paint and cleaning is complete and satisfactory clearance verification achieved.
5. Onsite Stripping
   a. Apply paint removers in accordance with manufacturer's recommendations.
   b. Test paint remover in inconspicuous location approved by Architect to avoid damage to substrate.
   c. Do not damage adjacent surfaces.
   d. Collect all paint chips, dust and debris and seal in 6 mil plastic bags.
6. Work Stoppage Criteria During Lead Activities

a. During lead related activities, stop work immediately if damaged containment barriers are discovered or if dust or paint chips are discovered outside of lead work area.
b. Prior to resumption of lead activities, perform cleanup of areas adjacent to lead work area using HEPA vacuums or wet cleaning methods.

D. Clean Up Procedures
1. Exterior
a. At end of each day, whether or not lead related activities are complete, clean up and store all removed components, debris, and plastic sheeting drop cloths in lockable containers with solid floors, walls and ceilings until transported off site.
b. HEPA vacuum and wash all plastic sheeting with lead specific detergent.
c. Place all plastic sheeting used to cover ground and seal openings to interior of building in containers.
1) A certified renovator must perform a visual inspection to determine whether dust, debris or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris or residue is present, these conditions must be eliminated and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.
2. Interior
a. Conduct ongoing cleaning during lead related activities, including regular removal of large and small debris.
b. Clean up visible debris and components prior to leaving lead work site at end of work shift.
c. Decontaminate all tools, equipment, and worker protection gear before removing from contaminated areas.
d. Wait at least 1 hour after active lead removal or disturbance has ceased before final cleaning.

E. After a successful visual inspection, a certified renovator must:
1. Verify that each windowsill in the work area has been adequately cleaned, using the following procedure.
2. Wipe the windowsill with a wet disposable cleaning cloth that is damp to the touch. If the cloth matches or is lighter than the cleaning verification card, the windowsill has been adequately cleaned.
3. If the cloth does not match and is darker than the cleaning verification card, re-clean the windowsill, then either use a new cloth or fold the used cloth in such a way that an unused surface is exposed, and wipe the surface again. If the cloth matches or is lighter than the cleaning verification card, that windowsill has been adequately cleaned.
4. If the cloth does not match and is darker than the cleaning verification card, wait for 1 hour or until the surface has dried completely, whichever is longer.
5. After waiting for the windowsill to dry, wipe the windowsill with a dry disposable cleaning cloth. After this wipe, the windowsill has been adequately cleaned.
6. Wipe uncarpeted floors and countertops within the work area with a wet disposable cleaning cloth. Floors must be wiped using an application device with a long handle and a head to which the cloth is attached. The cloth must remain damp at all times while it is being used to wipe the surface for post-renovation cleaning verification. If the surface within the work area is greater than 40 square feet, the surface within the work area must be divided into roughly equal sections that are each less than 40 square feet. Wipe each such section separately with a new wet disposable cleaning cloth. If the cloth used to wipe each section of the surface within the work area matches the cleaning verification card, the surface has been adequately cleaned.
7. If the cloth used to wipe a particular surface section does not match the cleaning verification card, re-clean that section of the surface as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of this section, then use a new wet disposable cleaning cloth to wipe that section again. If the cloth matches the cleaning verification card, that section of the surface has been adequately cleaned.
8. If the cloth used to wipe a particular surface section does not match the cleaning verification card after the surface has been re-cleaned, wait for 1 hour or until the entire surface within the work area has dried completely, whichever is longer.
9. After waiting for the entire surface within the work area to dry, wipe each section of the surface that has not yet achieved post-renovation cleaning verification with a dry disposable cleaning cloth. After this wipe, that section of the surface has been adequately cleaned. When the work area passes the post-renovation cleaning verification, remove the warning signs.

F. Removal of Work Area Containment
1. Do not remove remaining plastic sheeting, barriers, wash station, decontamination facilities, engineering controls and ancillary items until satisfactory clearance verification results are achieved.
2. Notify Owner immediately if any residual lead debris is identified during removal of plastic sheeting, barriers, decontamination facilities, negative pressure equipment and ancillary items, and clean up debris.
3. Clean all tape, glue, staples, etc. used in lead work process.
4. Repair damage to walls, floors, ceilings, fixtures, or other items not scheduled for demolition or lead work to pre-lead work condition. Where finishes are damaged, refinish or repaint entire object or to nearest break in surface of walls, ceilings, soffits, etc.
5. Remove entire containment when partial occupancy by Owner is required before Owner occupies area or other contractors occupy space for additional construction as required.
6. Paint or otherwise seal treated surfaces not scheduled for painting.

3.04 WASTE SEGREGATION AND CHARACTERIZATION

A. Segregate waste in following categories:
   1. Removed components (Considered construction and demolition debris for bidding purposes).
   2. Paint chips, dust and filters from HEPA vacuums (Considered hazardous waste for bidding purposes).
   3. Respirator filter cartridges, rags, sponges, mops, scrapers and other materials used for testing lead work, and clean-up (Considered construction and demolition debris for bidding purposes).
   4. Contaminated soil (Considered hazardous waste for bidding purposes).
   5. Cleaned plastic sheeting and disposable work clothes (Considered construction and demolition debris for bidding purposes).

B. Sample each container of waste to determine if it is characterized as hazardous waste, treating each sample as follows:
   1. Prepare using Toxicity Characteristic Leachate Procedure, EPA method 1311.
   2. Analyze for lead using EPA method 6010, 6020, 7420 or 7421.
   3. Analyze for any other hazardous characteristic introduced into waste by lead procedures.

C. Consider cleaned plastic sheeting and disposable work clothes not sufficiently cleaned as hazardous waste and dispose as hazardous waste at no additional cost to Owner.

D. Maintain each waste category above in separate hard walled lockable containers until waste characterization is complete. If waste mixed from different categories, dispose all mixed waste as hazardous waste at no additional cost to Owner.

3.05 FIELD QUALITY CONTROL

A. Inspection of Barriers: Provide inspection of all barriers at least twice daily by Contractor's Supervisor and record inspections and observations in daily project log.

B. Repairs to Barriers and/or Enclosure Systems: Repair damage and defects in barriers and enclosure systems immediately upon discovery and prior to resumption of lead activities.

C. Testing By Owner: Owner reserves right to obtain independent monitoring and sampling services to provide independent documentation regarding compliance with regulatory requirements. Where Owner provides monitoring, sampling (or both), use most stringent results from inspections, daily air sampling and clearance sampling.

D. Contractor Requirements
   1. Provide air sampling as required by 29 CFR 1926.62.
   2. Provide sampling and analysis for waste characterization.
   3. Provide access to lead work areas for Owner's Monitor / Sampling Technician as needed to observe all lead related work and collect samples.
   4. Provide adequate lighting, ladders, scaffolding, and similar items to enable Monitor / Sampling Technician to perform visual inspections of all surfaces within lead work areas as needed.
   5. Provide sufficient temporary electrical power to locations within lead work areas, as required, to supply high volume air sampling pumps for daily.
   6. Do not perform any monitoring functions with Contractor's personnel or with firms wholly or partly owned by Contractor. Notify Owner and Architect immediately of any conflict of interest between Contractor and any firm providing monitoring, sampling or laboratory analysis.
   7. Contractor retains complete and total responsibility for complying with Contract Documents and all regulatory requirements.

E. Area Air Sampling Procedures (If used): Comply with provisions of NIOSH 7082

F. Clearance Sampling Procedures (If Used)
   1. Owner reserves right to obtain independent monitoring and sampling services to provide independent documentation regarding compliance with regulatory requirements. Where Owner provides monitoring, sampling (or both), use most stringent results from inspections, daily air sampling and clearance sampling.

3.06 PACKAGING, TRANSPORTATION AND WASTE DISPOSAL PROCEDURES

A. Use hazardous waste characterization performed in accordance with Waste Segregation and Characterization" above to document and confirm classification of waste. Prior to removing waste from site, confirm in writing to Owner:
   1. Results of waste characterization testing.
   2. Identification of waste documented to have waste classification identified in "Waste Segregation and Characterization" above.
   3. Identification of waste characterization varying from "Waste Segregation and Characterization" above.

B. Packaging: Package, label, and mark all hazardous waste materials in accordance with applicable requirements of 49 CFR 173, 178 and 179.

C. Hazardous Waste Determination: Provide analysis required by Treatment, Storage or Disposal facility to document hazardous waste determination.

D. Hazardous Waste Manifests
   1. Maintain manifest from date of transport until date of disposal, destruction or recycling.
   2. Return fully executed manifests to Owner within 60 days of date waste accepted by initial transporter.
   3. Use following type of manifest as applicable:
      a. If waste disposed of in New York State or if waste disposed in state not requiring use of specific manifest form, use New York State Uniform Hazardous Waste Manifest.
      b. If waste disposed of in state other than New York State and use of specific manifest form is required, use manifest required by state where waste is disposed in lieu of New York State Uniform Hazardous Waste Manifest.
   4. Complete manifest and deliver to Owner for review and signature.
   5. Retain copies of manifest required to remain with hazardous waste shipment and deliver remaining copies to Owner.
   6. Advise Owner regarding required distribution of manifest, both verbally and in writing.

E. Disposal - Transport hazardous waste to treatment or disposal facility complying with following requirements:
   1. Permitted, licensed or registered by state to dispose of hazardous waste.
   2. Possesses interim status to dispose of hazardous waste.
   3. Authorized to manage hazardous waste under Resource Conservation and Recovery Act (RCRA).
   4. Beneficially uses/re-uses or legitimately recycles/reclaims waste; or treats waste prior to beneficial use/reuse or legitimate recycling/reclamation.

F. Construction and Demolition Debris: Dispose of material determined to be Construction and Demolition Debris as such in accordance with 6 NYCRR 360 and 364. Provide trip tickets or other documentation clearly identifying amount of material removed from site, transported to disposal site and disposed of, including at least:
   1. Name, address and telephone of waste generator.
   2. Approximate quantity.
   3. Name, and telephone of disposal site operator.
   4. Name and physical site location of disposal site.
   5. Name, address and telephone number of transporter.

-- END OF SECTION --

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Form-facing material for cast-in-place concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each of the following:
   1. Exposed surface form-facing material.
   2. Concealed surface form-facing material.
   3. Form ties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, brace, and maintain formwork, in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
   2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:
   1. Provide continuous, true, and smooth concrete surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints.
   3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
      a. Plywood, metal, or other approved panel materials.
      b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
   1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:
1. Surface Finish-1.0: ACI 117 Class D, 1 inch (25 mm).
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch (6 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.
1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
1. Provide and secure units to support screed strips.
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Do not chamfer exterior corners and edges of permanently exposed concrete unless otherwise noted.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches (305 mm).

K. Form openings, chases, offsets, sinkages,, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:
1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated on Drawings.
    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.

2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:
1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION

SECTION 032000 CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:
a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420).

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.
1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
2. Stagger splices in accordance with ACI 318 (ACI 318M).

G. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches (305 mm).

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.

4. Lace overlaps with wire.

3.3 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:
1. Steel-reinforcement placement.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Aggregates.
7. Admixtures:
   a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
8. Vapor retarders.
9. Curing materials.
10. Joint fillers.
11. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
10. Intended placement method.

11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Samples: For vapor retarder.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:
1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Admixtures

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Research Reports:
1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder showing compliance with ICC AC380.

F. Preconstruction Test Reports: For each mix design.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.7 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder material and accessories for sheet vapor retarder and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:
1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type I/II,.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.
5. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Alkali-Silica Reaction: Comply with one of the following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
      b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

   2. Maximum Coarse-Aggregate Size:
      a. Footings and Foundation Walls and piers: 1" inch nominal.
      b. Slabs-on-Grade: 1" inch nominal.
      c. Concrete/metal deck composite slabs: 3/4" inch nominal
      d. Interior metal pan stairs and landings: 1/2" maximum
      e. Coarse Aggregate shall be crushed limestone.

   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
   1. Color:
      a. Ambient Temperature Below 50 deg F (10 deg C): Black.
      b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
      c. Ambient Temperature Above 85 deg F (29 deg C): White.

D. Curing Paper: Eight-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable or complying with ASTM C1602/C1602M.

F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Floor Slab Protective Covering: Eight-feet- (2438-mm-) wide cellulose fabric.

2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand, as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested in accordance with ASTM C109/C109M

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested in accordance with ASTM C109/C109M.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Slag Cement: 50 percent by mass.
   3. Silica Fume: 10 percent by mass.
   4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
   5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.8 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
1. Exposure Class: ACI 318 (ACI 318M) F1.
2. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
3. Maximum w/cm: 0.50.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm), plus or minus 1 inch (25 mm)before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
   a. Exposure Class F1: 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B: Normal-weight concrete used for foundation walls.
1. Exposure Class: ACI 318 (ACI 318M) F1.
2. Minimum Compressive Strength: 4,500 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm), plus or minus 1 inch (25 mm),before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
   a. Exposure Class F1: 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: ACI 318 (ACI 318M) F0.
2. Minimum Compressive Strength: 4,500 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Minimum Cementitious Materials Content: 540 lb./cu. yd. (320 kg/cu. m).
5. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm), plus or minus 1 inch (25 mm), before adding high-range water-reducing admixture or plasticizing admixture at Project site.
6. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Class D: Normal-weight concrete used for slabs on metal deck.
1. Exposure Class: ACI 318 (ACI 318M) F1.
2. Minimum Compressive Strength: 4,500 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Minimum Cementitious Materials Content: 540 lb./cu. yd. (320 kg/cu. m).
5. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm), plus or minus 1 inch (25 mm), before adding high-range water-reducing admixture or plasticizing admixture at Project site.
6. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Class E: Normal-weight concrete used for interior metal pan stairs and landings:

1. Exposure Class: ACI 318 (ACI 318M) F0.
2. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
3. Maximum w/cm: 0.53.
4. Minimum Cementitious Materials Content: 470 lb./cu. yd. (279 kg/cu. m).

5. Maximum Size Aggregate: 1/2 inch (13 mm).
6. Slump Limit: 3 inches (75 mm), plus 1 inch (25 mm) or minus 2 inches (50 mm).
7. Air Content: 0 percent, plus or minus 0.5 percent at point of delivery.
8. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
9. Retarding Admixture: Not allowed.
10. Accelerating Admixture: Not allowed.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Daily access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
   4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
   4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
   1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
   2. Place joints perpendicular to main reinforcement.
      a. Continue reinforcement across construction joints unless otherwise indicated.
      b. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints to a depth as indicated.
   1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
   2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
   2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.
   3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
      a. Do not use vibrators to transport concrete inside forms.
      b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
      c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
      d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Do not place concrete floors and slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Maintain reinforcement in position on chairs during concrete placement.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Level concrete, cut high areas, and fill low areas.
   6. Slope surfaces uniformly to drains where required.
   7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
   8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
   1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
      a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
      b. Remove projections larger than 1 inch (25 mm).
      c. Tie holes do not require patching.
      d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
      e. Apply to concrete surfaces not exposed to public view.

   2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
      a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
      b. Remove projections larger than 1/4 inch (6 mm).
      c. Patch tie holes.
      d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
      e. Locations: Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing.

C. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:
    a. Slabs on Ground:
        1) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.

    b. Suspended Slabs on Metal Deck:
        1) Thickness tolerance -1/4 inch
        2) Entire slab ¾" +/- from design elevation

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb./sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1,) before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.

d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Begin curing immediately after finishing concrete.

2. Interior Concrete Floors:
a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
a) Lap edges and ends of absorptive cover not less than 12-inches (300-mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Curing Compound:
1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer [unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project].

3.11 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:
   1. Repair and patch defective areas when approved by Architect.
   2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.
      a. Limit cut depth to 3/4 inch (19 mm).
      b. Make edges of cuts perpendicular to concrete surface.
      c. Clean, dampen with water, brush-coat holes and voids with bonding agent.
      d. Fill and compact with patching mortar before bonding agent has dried.
      e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
      a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
      b. Compact mortar in place and strike off slightly higher than surrounding surface.

   3. Repair defects on concealed formed surfaces that will affect concrete durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

   1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
      a. Correct low and high areas.
      b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

   2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inches (0.25 mm) wide or that penetrate reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   3. After concrete has cured at least 14 days, correct high areas by grinding.
   4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing them with patching mortar.
      a. Finish repaired areas to blend into adjacent concrete.

   5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
      a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce smooth, uniform, plane, and level surface.
      b. Feather edges to match adjacent floor elevations.

   6. Correct other low areas scheduled to remain exposed with repair topping.
      a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.
      b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce smooth, uniform, plane, and level surface.

   7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.
      a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
      b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
      c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
      d. Place, compact, and finish to blend with adjacent finished concrete.

e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.
   a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
   b. Dampen cleaned concrete surfaces and apply bonding agent.
   c. Place patching mortar before bonding agent has dried.
   d. Compact patching mortar and finish to match adjacent concrete.
   e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

   a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      1) Project name.
      2) Name of testing agency.
      3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      4) Name of concrete manufacturer.
      5) Date and time of inspection, sampling, and field testing.
      6) Date and time of concrete placement.
      7) Location in Work of concrete represented by samples.
      8) Date and time sample was obtained.
      9) Truck and batch ticket numbers.
      10) Design compressive strength at 28 days.
      11) Concrete mixture designation, proportions, and materials.
      12) Field test results.
      13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
      14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:
1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.
7. In-Field Reinforcing Steel Inspection: Includes verification of placement tolerances, splicing procedures, size and Grade, Stability (chairs and spacers), cleanliness, and condition of protective coating.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:
   a. One test at point of placement for each truck.
   b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
   a. One test for each truck.

4. Concrete Temperature: ASTM C1064/C1064M:
   a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test [per truck] [for each composite sample].

5. Compression Test Specimens: ASTM C31/C31M:
   a. Cast and laboratory cure two sets of two 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample, plus one additional to hold.

6. Compressive-Strength Tests: ASTM C39/C39M.
   a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days. Test one additional cylinder at 56 days for concrete that did not meet 28-day compressive strength requirement.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor should evaluate operations and provide corrective procedures for protecting and curing concrete in-place.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).

9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

10. Additional Tests:
    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
       1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

A. Protect concrete surfaces as follows:
   1. Protect from petroleum stains.
   2. Diaper hydraulic equipment used over concrete surfaces.
   3. Prohibit vehicles from interior concrete slabs.
   4. Prohibit use of pipe-cutting machinery over concrete surfaces.
   5. Prohibit placement of steel items on concrete surfaces.
   6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION

SECTION 03 3543 - POLISHED CONCRETE FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials and procedures for polishing and finishing concrete floors and slabs.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
E. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 REFERENCE STANDARDS

A. American Concrete Institute (ACI) – Specification for Polished Concrete Slab Finishes ACI 310.1-20.
B. American National Standard Institute / National Floor Safety Institute
   1. ANSI/NSFI B101.1 Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials.
   2. ANSI B101.3-Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials.
C. American Society of Concrete Contractors (ASCC).
D. ASTM International (ASTM):
   1. C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
   2. C1353 – Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser
   3. D523- Standard Test Method for Specular Gloss.
   4. D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
   5. D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
   6. E96/96M Method B (Water Method) - Standard Test Methods for Water Vapor Transmission of Materials.
   7. G154 -Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Proceedures.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submital procedures.
C. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
D. Submit description for protection of surrounding areas, surface preparation, application, and final cleaning.
E. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years of documented experience.
B. Installer Qualifications:
   1. Concrete Polishing Council (CPC) Craftsman Supervisor or equivalent on site during work.
   2. Applicator to be familiar with the specified requirements and the methods needed for proper performance of work of this section. Applicator must have availability of proper equipment to perform work within scope of this project on a timely basis. Applicator should have successfully performed a minimum of 5 projects of similar scope and complexity.
C. Slab Aesthetics Testing: Record measurements of Distinction of Image (DOI), Gloss, and Haze at time of mock-up.
   1. Test Methods:
      a. Test DOI in accordance with the requirements of ASTM D 5767 using the Rhopoint IQ GM14400 instrumentation.
      b. Measure DOI in locations adjacent to the location of the DCOF measurement.

1.07 PREINSTALLATION MEETING

A. Conduct preinstallation meeting at Project site prior to commencement of concrete finishing, grinding, polishing, or application of concrete treatments.

B. Attendees: Require attendance by Contractor, Architect, concrete installer, concrete polishing contractor, concrete treatment manufacturer's representative, and representatives of other trades whose work may affect finished concrete surfaces.

C. Review and coordinate the following:

1. Existing slab conditions, including repairs, cracks, previous coatings or treatments, staining, and variations that may affect final appearance.
2. New concrete mix design, placement, finishing, curing, protection, and timing of subsequent treatments.
3. Grinding and polishing procedures for existing and new concrete, including aggregate exposure and required ACI 310.1 appearance level.
4. Densifier, protective treatment, application rates, number of coats, burnishing, and compatibility of products.
5. Requirements for field mockups and criteria for acceptance of appearance, sheen, aggregate exposure, color variation, and repairs.
6. Sequencing with adjacent construction and protection of completed work from staining, damage, and construction traffic.
7. Cleaning, maintenance, and final restoration procedures prior to Substantial Completion.
8. Applicable LEED requirements.

1.08 MOCK-UP

A. For polishing results and coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

1. Confirm surface preparation procedures, coverage rate, reaction time, finished appearance, etc. Use the manufacturers' application instructions. Let test area dry thoroughly before inspection. Obtain owner's approval before proceeding. Keep test area available for comparison throughout the project.

B. Mock-Up Size: 10 feet square.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Store concrete hardener/densifier and surface protectant treatment in environment recommended on published manufacturer's product data sheets.

1.10 FIELD CONDITIONS

A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting performance and finishing requirements.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

PART 2 PRODUCTS

2.01 PREPARATION MATERIALS

A. Liquid Concrete Repair Material: Low-odor, liquid fill material used to fill pinholes, small air voids and pop-outs, micro-cracks, and other gaps in concrete surface during grinding.

1. Product: PROSOCO Consolideck Grind-N-Fill.

B. Pre-Densifier Concrete Cleaner: Cleaner to remove dirt, oil, grease, and other stains from existing slab surface.

1. Product: PROSOCO Consolideck Cleaner/Degreaser

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.

1. Composition: Lithium silicate.
2. Products for existing slab areas:
   a. PROSOCO, Inc; Consolideck LS: www.prosoco.com/consolideck/#sle.

B. Products for new/green concrete slab areas:
   1. PROSOCO, Inc; Consolideck LS/CS: www.prosoco.com/consolideck/#sle.
   2. PROSOCO, Inc; Consolideck BD1 (for use if concrete mix includes Tyle 1L portland-limestone cement)

2.03 PROTECTIVE TREATMENTS

A. General Purpose high-gloss film forming premium sealer, lithium silicate hardener/densifier.
   1. Slip-resistance: Finished floor system shall achieve a wet dynamic coefficient of friction (DCOF) of not less than 0.42 when tested in accordance with ANSI B101.3, or as otherwise required by applicable code.
   2. Product: PROSOCO, Inc; LSGuard

2.04 EQUIPMENT

A. Conform to ACI 310.1 Part 2.2, except where more stringent requirements are specified below.
B. Auto Scrubber Machine: For cleaning operations.
C. Hand Grinder or stand-up edger for edge grinding/polishing.
D. Grinding/Polishing Equipment:
   1. Dry grinding/polishing machines shall include a dust extraction system, including HEPA filtration vacuum.
E. Diamond Segments:
   1. Use heads from the same manufacturers throughout the entirety of the project.
F. Diamond Heads Types:
   1. Metal Diamonds: 80 or 150.
   2. Hybrid Style Diamonds: 50 or 100.
   3. Resin Bonded, Phenolic Diamonds: 100, 200, 400, 800, 1500, and 3000 (if necessary).
G. Burnishing Machine and Burnishing Pads to produce specified results.
H. Burnishing Machine: High speed burnisher, generating pad speeds of 1,500 RPM or higher, as recommended by protective treatment manufacturer. Dust skirt must be installed at time of work.
I. Burnishing Pads: as recommended by protective treatment manufacturer.
   1. White Burnishing Pad, non-abrasive.
   2. PROSOCO Consolideck Heat Pad
J. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of product.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate with installer present for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work
B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions
C. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of specified product from surfaces. Use appropriate concrete cleaners approved by the concrete surface treatment manufacturer where necessary. Rinse thoroughly using pressure water spray to remove cleaner residues. Allow surfaces to dry completely before application of product.
B. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Architect. Allow repair materials to cure completely before application of product.
C. Variations in substrate texture and color will affect final appearance and should be corrected prior to application of sealer/hardener system and the polishing steps.
D. Protect surrounding areas prior to application. If product is accidentally misapplied to adjacent surfaces, flush with water immediately before material dries.
E. Avoid contact in areas not to be treated. Avoid contact with metal, glass and painted surfaces.

F. Seal open joints in accordance with Section 07 92 00.
G. Apply specified sealants and caulking and allow complete curing before application of penetrating concrete hardener/densifier.
H. Do not proceed until unsatisfactory conditions have been corrected.

3.04 CONCRETE GRINDING, HONING, AND POLISHING

A. Adhere to industry standard and conform to ACI 310.1 for grinding, honing, and polishing procedures for dry and wet grinding and honing, except where more stringent requirements are specified below.
B. Scrub and rinse slab surface with clean water and vacuum with auto-scrubber between and after final passes.
C. Sequential progression of diamond tooling steps shall be required and limited to no more than double the grit value of the previous diamonds used.
D. Overlap adjacent passes by 25 percent.
E. Perform each pass perpendicular to the other pass north/south then east/west; multiple passes may be needed.
F. Progressively grind, hone and polish the slab surface utilizing approved diamond segments as necessary to produce Finishing requirements and appearance established by approved field mockup.
    1. Apply liquid concrete repair material to fill gaps, voids and pop-outs during grinding operation per manufacturer's published recommendations.
    2. Apply cutting aid chemical during the initial wet grinding process per manufacturer's published recommendations. (Typically before the 200 grit resin or lower).

3.05 APPLICATION OF PENETRATING CONCRETE HARDENER/DENSIFIER

A. Apply hardener/densifier at the rate of 500 to 700 square feet per gallon with a low pressure sprayer fitted with a 0.5 gpm spray tip. (Typically after 200-grit and no later than 400 grit).
B. Apply sufficient material to keep concrete surface wet for 5 to 10 minute period, without producing puddles.
C. Allow treated surface to dry.
D. Continue progressively polishing floor with required resin diamonds as necessary to produce desired final finish.

3.06 APPLICATION OF INTERIOR CONCRETE PROTECTIVE TREATMENT

A. Apply per manufacturer's published recommendations to clean, dry slab at the completion of mechanically polishing the slab surface.
B. Lightly wet a clean microfiber pad with protective treatment and wring out excess, leaving the pad damp.
C. Working from one control joint to another, apply a light, fine spray of protective treatment to a small section of the floor using a clean, pump-up sprayer fitted with a 0.5 gpm spray tip, at an estimated coverage rate of 2000 to 3000 square feet per gallon.
D. Using the damp microfiber pad and firm downward pressure, immediately spread the protective treatment to produce a thin, even coating. Spread the product as far as possible while maintaining a wet edge. Properly applied, protective treatment dries quickly. Stop spreading once drying begins. Avoid overlapping.
E. Once dry, high- speed burnish slab surface fitted with manufacturer recommended burnishing pad to increase gloss and to help the treatment fuse and bond with the concrete for increased durability and longevity. Surface temperatures immediately behind the burnisher must achieve 90.5 degrees Fahrenheit. (Burnish between coats if multiple applications are desired.)
F. Repeat above steps 1 through 6, as necessary for additional applications of protective treatment, to achieve desired final finish (Maximum 3 coats).

3.07 SLAB PROTECTION

A. Comply with provisions of ACI 310.1 specification for slab protection, except where more stringent requirements are specified below.
B. Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities until possession.
C. Do not drag or drop equipment or material across the slab which will scratch or chip it.
D. Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to floor slab.
E. Clean up spills on slab immediately. Provide cleaning chemicals and absorptive materials.
F. Develop a concrete protection procedure which addresses the following procedures:
    1. Communication of protection plan to subcontractors and vendors.
    2. Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at Site.
G. Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's published recommendations.

3.08 FINISHNG REQUIREMENTS

A. Interior exposed finished slab areas must consist of the following:
   1. Slab surface must meet the desired sheen, as discussed in Pre-Installation meeting and be consistent with approved Mock-up.
   2. Slab surface must have a consistent look and exhibit a finish that has no evidence of streaking or burnish marks.
   3. White residue or hazy appearance is not acceptable.
   4. Exposure of aggregate ACI 310.1 Table 3.2.3.1, Aggregate Exposure Class A-Cream or B-Fine Aggregate.
   5. Interior exposed finished slab areas must consist of the following CPAA Gloss Level:

B. Interior exposed finished slab areas must meet the ACI 310.1 Table 3.2.4.1- Appearance levels for distinctness of image (DOI) Level 3.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties material test reports substantiating compliance with requirements.
b. For thin brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C67.
d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include name of manufacturer, brand name, and type.

3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

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. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. 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 (600 mm) down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. 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.

D. 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 TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.
1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

2.5 MASONRY LINTELS

A. General: Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

E. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4-inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

F. Aggregate for Grout: ASTM C404.

G. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.
2. Wire: Fabricate from 3/16-inch- (4.76-mm-) diameter, hot-dip galvanized steel.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, wire.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.11 MORTAR AND GROUT MIXES

A. General: 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. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.

4. For reinforced masonry, use portland cement-lime mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.
4. For interior nonload-bearing partitions, Type O may be used instead of Type S.

D. Grout for Unit Masonry

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

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.

3.2 INSTALLATION, GENERAL

A. Thickness: 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 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.

E. 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.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4-inch (6 mm) in a story height or 1/2-inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond pattern; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond by lapping not less than 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush where indicated to receive waterproofing and air barriers unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide masonry lintels where shown and were openings of more than 12 inches (305 mm) for block-size unites are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level 2 in TMS 402

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

I. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

3.12 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, 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 non-masonry 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 applicable cleaning methods indicated in NCMA TEK 8-4A.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor’s property. At completion of unit masonry work, remove from Project site.

B. Excess masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner’s property.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Infill of existing brick walls with new brick and recovered brick
B. Mortar and grout.

1.02 REFERENCE STANDARDS

A. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2013.
B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.
C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2026.
D. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.
F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for fabricated wire reinforcement, mortar, and masonry accessories.

1.04 MOCK-UPS

A. Locate where directed.
B. Mock-up may remain as part of work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Manufacturers: for new brick.
    1. Belden Brick: www.beldenbrick.com.
    2. Endicott Clay Products Co; Face Brick - FBX: www.endicott.com.
B. Building (Common) Brick: ASTM C62, Grade SW; solid units.
    1. Nominal size: As indicated on drawings.

2.02 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type N.
    1. Colored Mortar: Premixed cement as required to match Architect's color sample.
B. Hydrated Lime: ASTM C207, Type S.
C. Mortar Aggregate: ASTM C144.
    1. Match size, texture, and gradation of aggregate in existing mortar as closely as possible
D. Water: Clean and potable, free of oils, acids, alkalis, salts, and organic matter.
E. Admixtures: Do not use unless proposed, tested, and accepted in Preconstruction Testing Phase prior to beginning work.

2.03 MORTAR MIXING

A. General:
    1. Measurement and Mixing: Measure cementitious and aggregate material in dry conditions by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in clean mechanical batch mixer.
    2. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 1 to 2 hours. Add remaining water in small portions until desired consistency is reached. Use mortar within 30 minutes of final mixing. Do not retemper or use partially hardened material.
B. Colored Mortar: Produce mortar of color required by use of selected ingredients. Do not adjust proportions without Architect’s acceptance.
C. Mortar Proportions: Match binder type of existing mortar. Based on removals and the age of the building, the binder is likely lime.

D. Mortar Proportions: One part Natural Hydraulic Lime, and two and a half parts mortar aggregate (1:2.5).
E. Trial Mix: Prepare trial mixes of pointing and rebuilding mortars.

PART 3 EXECUTION

3.01 INSTALLATION

A. Salvage as many whole, undamaged bricks as possible.
B. If insufficient number of brick are able to be salvaged, use new common brick for inner wythe.
C. Maintain coursing of adjacent masonry. Remove cut units as necessary to tooth in new brick to provide a uniform appearance.

3.02 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
B. Remove excess mortar and mortar smears as work progresses.
C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.03 CLEANING

A. Remove excess mortar and mortar droppings.
B. Clean soiled surfaces with cleaning solution.

END OF SECTION

SECTION 04 7200 - CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are indicated on drawings as "cast stone".

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

C. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2025.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.

G. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2026.

I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

J. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

K. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Test results of cast stone components made previously by the manufacturer.

1. Include one copy of ASTM C1364 for Architect's use.

C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

D. Mortar Color Selection Samples.

E. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

F. Full-Size Samples, For Review:

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
3. Manufacturer's production facility currently holds a Plant Certification from the Cast Stone Institute or the Architectural Precast Association.
4. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
   1. Lakelands
   2. Steps Plus
   3. Southside Precast
   4. Sun Precast in PA
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Units: Type I, white or gray as required to match Architect 's sample.
   2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Pigments: ASTM C979, inorganic iron oxides; do not use carbon black.

E. Admixtures: ASTM C494/C494M.

F. Water: Potable.

G. Reinforcing Bars: ASTM A615/A615M deformed bars, epoxy coated.
   1. Epoxy coated in accordance with ASTM A775/A775M.

H. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

I. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

J. Mortar: Portland cement-lime, ASTM C270 Type N; do not use masonry cement.

K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:

1. Drench cast stone components with clear, running water immediately before installation.
2. Set units in a full bed of mortar unless otherwise indicated.
3. Fill vertical joints with mortar.
4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 TOLERANCES

A. Joints: Make all joints 3/8 inch, except as otherwise detailed.

1. Rake mortar joints 3/4 inch for pointing.
2. Remove excess mortar from face of stone before pointing joints.
3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
4. Leave the following joints open for sealant:
   a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
   b. Joints in projecting units.
   c. Joints between rigidly anchored units, including soffits, panels, and column covers.
   d. Joints labeled "expansion joint".

B. Installation Tolerances:

1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.04 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

1. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
2. Repair methods and results subject to Architect 's approval.
   a. Units in areas of high traffic or subject to normal viewing at 6 feet or less shall be replaced at Architect's discretion.

3.05 CLEANING

A. Keep cast stone components clean as work progresses.

3.06 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Shrinkage-resistant grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Structural-steel materials.
   2. High-strength, bolt-nut-washer assemblies.
   3. Anchor rods.
   4. Threaded rods.
   5. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment Drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Mill test reports for structural-steel materials, including chemical and physical properties.

D. Product Test Reports: For the following:
   1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.

E. Survey of existing conditions.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:
   1. ANSI/AISC 303.
   2. ANSI/AISC 360.
   3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
   1. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
      a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
      b. Use Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles, M, S-Shapes: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
   1. Weight Class: Standard unless otherwise noted.
   2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. Interior: High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.
   2. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1 (Type 10.9-1), compressible-washer type with plain finish.

B. Exterior: Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
   1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with mechanically deposited zinc coating finish.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.
   1. Configuration: Straight Hooked.
   2. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
   3. Plate Washers: ASTM A36/A36M carbon steel.
   4. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
   5. Finish: Plain (Interior) Galvanized (Exterior)

B. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
   1. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
   2. Plate Washers: ASTM A36/A36M carbon steel.
   3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
   4. Finish: Plain (Interior) Galvanized (Exterior)

C. Threaded Rods: ASTM A36/A36M.
   1. Nuts: ASTM A 63 (ASTM A563M) heavy-hex carbon steel.
   2. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
   3. Finish: Plain (Interior) Galvanized (Exterior)

2.5 PRIMER

A. Steel Primer:
   1. Comply with Section 099113 “Exterior Painting” and Section 099123 “Interior Painting & Transparent Finishing”

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened unless otherwise noted.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.
   3. Surfaces of high-strength bolted, slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Surfaces enclosed in interior construction.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
   1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
   2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M.
   4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Base plates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
   1. Joint Type: Snug tightened unless otherwise noted.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

3.6 PROTECTION

A. Touchup Painting: Cleaning and touchup painting are specified in 099113 “Exterior Painting” and Section 099123 “Interior Painting & Transparent Finishing”

END OF SECTION

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof deck.
   2. Composite floor deck.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Roof deck.
   2. Composite floor deck.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:
   1. Welding certificates.
   2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:
   1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.
   2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

C. Qualification Statements: For welding personnel.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:
      a. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated
4. Span Condition: As indicated.

2.4 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Galvanizing Repair Paint: ASTM A780/A780M

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories in accordance with SDI C and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.2 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
   1. Weld Diameter: 5/8 inch (16 mm), nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (300 mm) maximum.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 12 inches (300 mm), and as follows:
   1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
   1. End Joints: Lapped 2 inches (50 mm) minimum or butted at Contractor's option.

3.3 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 5/8 inch (16 mm), nominal.
   2. Weld Spacing:
      a. Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (300 mm) apart, but not more than 16 inches (460 mm) apart.
      b. Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 12 inches (300 mm), and as follows:
   1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
   1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
      a. Field welds will be subject to inspection.

   2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load bearing wall framing.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips.
6. Single deflection track.
7. Drift clips.
8. Post-installed anchors.
9. Power-actuated anchors.

B. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

C. Product test reports.

D. Research Reports:
1. For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency.

B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S240 for conditions indicated.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
   1. Grade: As required by structural performance
   2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90)

C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance
   2. Coating: G60 (Z180)

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
   2. Flange Width: 1-5/8 inches (41 mm)

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching minimum base-metal thickness of steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
   2. Flange Width: 1-3/8 inches (35 mm) 1-5/8 inches (41 mm)

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)

2. Flange Width: 1-5/8 inches (41 mm)

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
2. Flange Width: 1-5/8 inches (41 mm)

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips, Interior: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor, or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B, or SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: As indicated on drawings

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track.
   1. Fasten both flanges of studs to top and bottom tracks.
   2. Space studs as follows:
      a. Stud Spacing: As indicated on Drawings

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
   2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to bypassing and infill studs and anchor to building structure.
3. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on Drawings

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to studs and anchor to building structure.
3. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
B. Section 05 5100 - Metal Stairs.
C. Section 05 5213 - Pipe and Tube Railings.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Copies of Architect's Drawings, manufacturer's standard details or other non-project-specific details are not acceptable, and will be returned without review.
   2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.
B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
C. Plates: ASTM A283/A283M.
D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

2.04 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch.
C. Maximum Misalignment of Adjacent Members: 1/16 inch.
D. Maximum Bow: 1/8 inch in 48 inches.
E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 5100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.
B. Stairs with metal treads.
C. Structural steel stair framing and supports.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.
B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.
C. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
D. Section 05 5213 - Pipe and Tube Railings: Metal handrails for the stairs specified in this section.
E. Section 05 5213 - Pipe and Tube Railings: Metal handrails and balusters other than specified in this section.
F. Section 05 7000 - Decorative Metal: Guardrails and Handrails for metal stairs.
G. Section 09 9123 - Interior Painting & Transparent Finishing: Paint finish.

1.03 REFERENCE STANDARDS

A. AISC 207 - Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components; 2016.
B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2014.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.
G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
I. 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; 2026.
J. 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; 2025.
K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2026.
L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).
N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
O. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
    1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
    2. Include the design engineer's seal and signature on each sheet of shop drawings.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in NY State, or personnel under direct supervision of such an engineer.
B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.
C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.
2. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
   3. Dimensions: As indicated on drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.
   5. Concrete Reinforcement: Welded wire mesh.
   6. Concrete Finish: As required for finish(es) indicated..

D. Risers: Same material and thickness as tread pans.
   1. Nosing Depth: Not more than 1-1/2 inch overhang.
   2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: As indicated on drawings.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Railings: See Section 05 7000 Decorative metal.

G. Finish: Shop- or factory-prime painted.

H. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

A. Guards and Guard-mounted rails: See Section 05 7000 - Decorative Metal

B. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.
D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.
D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, and comply with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.
B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.
B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
F. Obtain approval prior to site cutting or creating adjustments not scheduled.
G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 055313 - BAR GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal bar gratings.

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for structural-steel framing system components.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Clips and anchorage devices for gratings.

B. Shop Drawings:
   1. Include plans, sections, and attachment details.
   2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittals: For gratings, including manufacturers' published load tables

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

B. Delegated Design Engineer qualifications.

1.4 QUALITY ASSURANCE

C. Delegated Design Engineer Qualifications: A Professional Engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

D. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes: AWS D1.2/D1.2M.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.

B. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

   1. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lb./sq. ft. (2.87 kn/sq. m).
   2. Limit total deflection to L/360 or ¼ inch whichever is less.

2.2 METAL BAR GRATINGS

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531

B. Pressure-Locked, Rectangular-Bar Aluminum Grating: Fabricated by swaging crossbars between bearing bars.
   1. Bearing Bar Spacing: 1-3/16 inches (30 mm)
   2. Bearing Bar Depth: 1 inch (25 mm)

3. Bearing Bar Thickness: 3/16 inch (4.8 mm)
4. Crossbar Spacing: 4 inches (102 mm)
5. Traffic Surface: Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive
6. Aluminum Finish: Mill finish

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum.
   2. Provide stainless steel fasteners for fastening stainless steel.

B. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; ASTM F593 (ISO 3506-1) for bolts and ASTM F594 (ASTM F836M) for nuts, Alloy Group 1 (A1).

2.4 ALUMINUM

A. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B221 (ASTM B221M), alloys as follows:
   1. Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
   2. Alloy 6061-T1, for grating crossbars.

2.5 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and 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.

F. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

   1. Provide no fewer than four saddle clips for each grating section containing rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over two bearing bars.
   2. Furnish threaded bolts with nuts and washers for securing grating to supports.

G. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
   1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

H. Do not notch bearing bars at supports to maintain elevation.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Fit exposed connections accurately together to form hairline joints.

3.2 INSTALLATION OF METAL BAR GRATINGS

A. Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

END OF SECTION

SECTION 05 7000 - DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal components for decorative metal railings.

B. Formed, perforated panels for screening and railings.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications.

B. Section 05 7100 - Decorative Metal Stairs.

C. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Schedule and conduct preinstallation meeting one week before starting work of this section. Attendees include:

1. Contractor.
2. Architect.
3. Owner's representative.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, anchors, and accessories.

C. Shop Drawings: Indicate elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

1. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.

D. Executed warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least ten years of documented experience.

1.07 MOCK-UPS

A. Provide mock-up of stair, railing system, and wall-mounted handrail, 3' feet long by 2' feet wide, illustrating each type of material, cladding, and finish.

B. Locate where directed.

C. Mock-up may not remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials for damage upon delivery. Replace damaged and unrepairable materials. Ensure replacement materials are indistinguishable from undamaged parts and finishes.

D. Prior to installation, store materials and components under cover in a dry location.

1.09 FIELD CONDITIONS

A. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after installation.

1.10 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for defects in materials, fabrication, finishes, and installation. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mesh panels for stair guardrail infill: Amico Architectural Metals; Gracia Expanded Mesh; www.amicoarchitectural.com
   1. Material: Steel
   2. Finish: Primed for shop finishing. See Section 09 9123.

B. Formed, perforated panels for exterior railings: Astyl Perforart; Blade Railing: www.astyl.com
   1. Material: 0.125" thick aluminum sheet.
   2. Finish: As selected by Architect from Manufacturer's full range.

C. Formed, perforated screening panels: Astyl Perforart; Frontal: www.astyl.com
   1. Material: 0.125" thick aluminum sheet.
   2. Finish: As selected by Architect from Manufacturer's full range.

2.02 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   3. Welding Materials: Comply with AWS D1.1/D1.1M.
   4. Mesh infill for railing panels; Amico Architectural Metals; Gracia Expanded Mesh: www.amicoarchitectural.com

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Welding Fittings: Factory- or shop-welded; joints and seams ground smooth.

2.04 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation from Plane: 1/16 inch in 48 inches.

2.05 FINISHES

A. General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions, and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

B. Steel Finishes:
   1. Shop-painted. Refer to section 09 9123 Interior Painting and Transparent Finishing.
   2. Color: As indicated on drawings.

2.06 ACCESSORIES

A. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure. Ensure attachment devices are of same material as components unless indicated otherwise.
B. Sealant: Silicone; black.
C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.
B. Verify field dimensions of locations and areas to receive work.
C. Notify Architect immediately of conditions that would prevent satisfactory installation.
D. Do not proceed with work until detrimental conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.
C. Anchor securely to structure.
D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
E. Weld connections that cannot be shop welded due to size limitations.
    1. Weld in accordance with AWS D1.1/D1.1M.
    2. Match shop welding and bolting.
    3. Clean welds, bolted connections, and abraded areas.
    4. Touch up shop primer and factory-applied finishes.
F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.03 CLEANING

A. Remove protective film from exposed metal surfaces.
B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.04 PROTECTION

A. Protect installed components and finishes from damage after installation.
B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
    1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.
B. Preservative treated wood materials.
C. Composite Insulation Sheathing Panels
D. Communications and electrical room mounting boards.
E. Concealed wood blocking, nailers, and supports.
F. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
E. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
F. Section 07 2700 - Air Barriers: Air barrier over sheathing.
G. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
F. PS 1 - Structural Plywood; 2023.
G. PS 20 - American Softwood Lumber Standard; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on insulated sheathing and application instructions.
C. Product Data: Submit technical data on wood treatment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
    1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
    2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
    3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
B. Provide sustainably harvested wood; see Section 01 6000 - Product Requirements for requirements.

C. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Wood construction panel laminated to insulation board.

1. Construction Panel: 7/16 inch (11 mm) oriented strand board (OSB).
2. Insulation Board: Polyisocyanurate foam plastic with cellulosic felt facer or glass fiber mat facer on major surface opposite construction panel.
3. Finished Panel: Comply with ASTM C1289, Type V.
4. Products:
   a. Henry, a Carlisle Company; R2+ Base: www.henry.com/#sle.
   b. Hunter Panels; Xci Ply: www.hunterpanels.com/#sle.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 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.

2.04 ACCESSORIES

A. Metal and Finish of Fasteners:

1. Preservative-Treated Wood:
   a. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
2. High Humidity Wood Locations: Hot-dip galvanized steel complying with ASTM A153/A153M.
3. Untreated Wood: Unfinished steel.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide nonstructural framing and blocking to support the following:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.

4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards, and tack and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
   1. Install plywood wall sheathing in accordance with manufacturer's current ICC-ES evaluation report for specified sheathing product.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   2. Install adjacent boards without gaps.

3.04 SITE-APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.05 CLEANING

A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 061516 - WOOD ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid-sawn wood roof decking.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: 24 inches (600 mm) long, showing the range of variation to be expected in appearance of wood roof decking.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of wood roof decking to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide air circulation within and around stacks and under temporary coverings. Stack wood roof decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

2.2 SOLID-SAWN WOOD ROOF DECKING

A. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.

B. Roof Decking Species:
1. Balsam fir, Douglas fir-larch, Douglas fir-larch (North), hem-fir, hem-fir (North), southern pine, spruce pine-fir (North), western hemlock, or western hemlock (North).

C. Roof Decking Nominal Size: 2 by 6.

D. Roof Decking Grade:
1. Select Decking.

E. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.

F. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.

G. Face Surface: Smooth.

H. Edge Pattern: Vee grooved.

2.3 ACCESSORY MATERIALS

A. Fasteners for Solid-Sawn Roof Decking: Provide fastener size and type complying with AITC 112 for thickness of deck used.

B. Nails: Common; complying with ASTM F1667, Type I, Style 10.

C. Penetrating Sealer: Clear sanding sealer complying with Section 099300 "Staining and Transparent Finishing" and compatible with topcoats specified for use over it.

2.4 FABRICATION

A. Seal Coat: After fabricating and surfacing roof decking, apply a saturation coat of penetrating sealer in fabrication shop.

B. Apply indicated finish materials to comply with Section 099300 "Staining and Transparent Finishing" in fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and support framing in areas to receive wood roof decking for compliance with installation tolerances and other conditions affecting performance of wood roof decking.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install solid-sawn wood roof decking to comply with AITC 112.
   1. Locate end joints for combination simple and two-span continuous lay-up.
   2. Glue adjoining roof decking courses together by applying a 3/8-inch (10-mm) bead of adhesive to the top of tongues, according to research/evaluation report.

B. Apply joint sealant to seal roof decking at exterior walls at the following locations:
   1. Between roof decking and supports located at exterior walls.
   2. Between roof decking and exterior walls that butt against underside of roof decking.
   3. Between tongues and grooves of roof decking over exterior walls and supports at exterior walls.

3.3 ADJUSTING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged roof decking if repairs are not approved by Architect.

3.4 PROTECTION

A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION

SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK AND MILLWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units, fixed.
   1. Thin CLT Wood Casework.
B. Specially fabricated custom millwork.
   1. Built-in Benches and Social Stair seating/stair elements.
   2. Built-in display shelving elements.
   3. Kitchenette and Work Area islands with integral casework.
   4. Wood Panel Systems, Peg Board System, Trim, and Accessories.
   5. Adjustable shelving system.
   6. Wood Trim, including but not limited to Standing Trim and Running Trim .
C. Stair treads and risers.
D. Countertops for architectural casework and millwork, including but not limited to wall panels and countertop support brackets.
E. Window Stools.
F. Hardware and Accessories.
G. Shop finishing.
H. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
E. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
F. Section 09 2116 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework, millwork, display cases, and countertop bracket supports.
G. Section 09 6500 - Resilient Flooring, Base, and Accessories: Resilient base at casework, millwork, and display cases.
H. Section 22 4000 - Plumbing Fixtures: Sinks and fittings installed in casework, millwork, and display cases.
I. Section 26 2726 - Wiring Devices: Switches, receptacles installed in casework, millwork, and display cases.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors. Consider top of casework as exposed when viewable from above.
B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.
C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and bottoms of cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
B. ANSI A208.1 - American National Standard for Particleboard; 2022.
C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.
E. ASTM D792 - Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013.
F. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.
G. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2016.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.
J. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.
K. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
L. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
M. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.
N. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Revision A, 1996.
O. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.
P. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.
Q. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
R. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
S. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.
T. PS 1 - Structural Plywood; 2023.
U. SEFA 2 - Installations; 2010.
V. SEFA 3 - Work Surfaces; 2010.
W. UL (DIR) - Online Certifications Directory; Current Edition.
X. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
Y. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.
B. Coordination:
   1. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other sections to ensure that interior architectural casework, millwork, and countertops can be supported and installed as indicated.
   2. Coordinate installation of casework, millwork, and countertops with installation of specified appliances, equipment, MEP components, and other related units of work specified in other sections to ensure that interior architectural work is located, sized to fit, and installed as indicated. MEP comonents includes but are not limited to unit ventilators, thermostats, light fixtures, receptacles and/or power modules, clocks, and plumbing fixtures.

1.06 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures.
C. Millwork shop AWI Membership Certificate.
D. Product Data: Provide Manufacturer's data sheet for each substrate, product, materials, hardware, and accessories to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.
E. Shop Drawings: Indicate casework, millwork, and countertop types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors, reinforcements, and blocking, placement dimensions and tolerances, clearances required, and utility locations, if any. Indicate materials, component profiles, fastening methods, jointing details, and accessories. Indicate fasteners that will be exposed in completed work.
   1. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.
   2. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   3. Provide the information required by AWMAC/WI (NAAWS).
   4. Verify dimensions by field measurements before fabrication and indicate on shop drawings.
   5. Where it is infeasible to verify field dimensions prior to generating shop drawings, include letter from contractor responsible for surrounding construction stating specific reasons that field dimensions are not available, and certifying that the finished surrounding construction shall conform to the dimensional requirements and installation tolerances indicated on the shop drawings. That contractor shall become solely responsible for modifications to new or existing work required to accommodate installation per the shop drawings, to the satisfaction of the Architect, and at no additional cost to the Owner.
   6. Include certification program label.

F. Samples: Submit actual samples of , minimum 2 inches square, illustrating each type and color of proposed decorative laminate, wood veneer, solid wood, edgebanding, and countertop finish.

G. Samples: Submit actual sample items of proposed pulls, hinges, shelf supports, locksets, and catches, demonstrating hardware design, quality, and finish.

H. Selection Samples: Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.

1. Selection Samples: For each finish product specified where color selection is not indicated or proposed material varies from Basis-of-Design, supply one set of color chips representing manufacturer's full range of available colors and patterns.
2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.

I. Fabricator's Qualification Statement.

J. Installer's Qualification Statement.

K. Installation Instructions: Manufacturer's installation instructions and recommendations.

L. Maintenance Data: Manufacturer's recommendations for care and cleaning.

M. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 01 6000 - Product Requirements for additional provisions.
2. Finish touch-up kit for each type and color of materials provided.
3. Spare parts: five percent of each type of hinges, pulls, catches, shelf supports, locks, removable trays, casters, mirrors, and rods, but not less than six of each type.
4. Extra Wood Panel System Material: Furnish quantity equivelent to 5 percent of each panel type, trim, and color.

N. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum ten years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   a. AWI Certified Millwork Shop.

B. Single Source Responsibility: Fabrication and installation of this work provided from single millwork shop.

C. Installer Qualifications: Company specializing in performing work of type specified, with minimum five years of documented experience.

D. Quality Standard:

1. Comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1.08 PRE-INSTALLATION MEETING

A. The following is a list of required attendees:

1. Owner or Owner's Representative
2. Architect.
3. Construction Manager.
4. General Contractor.
5. All subcontractors involved in removals, preparation, or installation of wood casework and millwork in work areas.

B. The following constitutes mandatory discussion items:

1. Finalize construction schedule and ensure availability of materials, installer's personnel, equipment, and facilities needed to avoid delays.
2. Review removal procedures and Owner notifications for existing casework and millwork to be salvaged to the owner.
3. Review requirements of all wood casework and millwork material installation.
4. Ensure substrate conditions and finishes are in compliance with requirements, including flatness and cleanliness.
5. Start of Work constitutes acceptance of installation surfaces and contractors adherence to the criteria in this specification.
6. Finalize "On Site Storage" arrangements for materials.
7. Cover temporary protection requirements for wood casework and millwork during and after installation.
8. Review proposed methods and procedures related to wood casework and millwork installation, including manufacturer's written instructions, and reach agreement to their conformance.

9. Outline repair procedures after installation.
10. Set procedure for preserving the environmental conditions of the spaces where wood casework and millwork installations shall take place.
11. Stress intent of mock-ups are to verify selections made under sample submittals, demonstrate aesthetic effects, and set quality standards for materials and execution with complete understanding of importance of adherence to manufacturer's instructions.
12. Review mock-up requirements, determine mock-up locations, and review schedule.

1.09 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Mock-ups: Install mock-ups to verify selections made under sample submittals, demonstrate aesthetic effects, and set quality standards for materials.
   1. Provide full size base cabinet and upper cabinet complete with drawers, door, adjustable shelf and countertop.

C. Locate where directed by Architect.

D. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at the time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. Store products in manufacturer's unopened packaging until ready for installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:
   1. Do not deliver or install casework and millwork until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:
   1. Store casework, millwork, and countertops in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.
   2. Protect units from moisture damage.
   3. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.11 FIELD CONDITIONS

A. During and after installation of wood casework and millwork, maintain temperature, humidity, and ventilation conditions in building spaces at same levels planned for occupancy and within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
   1. Humidity Monitoring: Monitor environmental conditions for a two week period prior to delivery and during installation of casework millwork, and countertop. Install a ThermoPro TP50W Digital Hygrometer or Equal in the area of work and record the temperature and humidity daily for record.
   2. Report conditions to Architect where relative humidity is above or below 25 to 55 percent as recommended by AWMAC/WI (NAAWS) for a period of two weeks prior to delivery and installation of wood casework, millwork, and countertops.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.12 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

B. Correct defective Work within specified period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
   1. Ruptured, cracked, or stained finish coating.
   2. Discoloration or lack of finish integrity.

3. Cracking or peeling of finish.
4. Delamination of components.
5. Failure of adhesives.
6. Failure of hardware.

C. Manufacturer Warranty: Provide one year manufacturer warranty for decorative laminate, wood veneer, substrates, hardware, and accessories. Complete forms in Owner's name and register with manufacturer.

D. Manufacturer Warranty: Provide five year warranty for casework and millwork commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

E. Installer Warranty: Provide five year warranty for casework and millwork commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

F. Finish Warranty: Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacing units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 CABINETS AND MILLWORK, GENERAL

A. Quality Standard: Custom Grade, in accordance with AWMAC/WI (NAAWS), unless noted otherwise.

2.02 WOOD-BASED COMPONENTS

A. Provide wood-based components meeting or exceeding requirements for specific grades indicated, but not less than the following.

B. Wood fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood, certified or labeled; see Section 01 8113 - Sustainable Design Requirements.

D. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

E. All composite wood products are to be made with adhesives and binders containing no added urea formaldehyde.

F. Hardwood Veneer Plywood: HPVA HP-1 Grade A; veneer core, type of glue recommended for application, species and cut as indicated, suitable for transparent finish. For use where plywood is exposed finish.
   1. 3/4 inch (18mm): 13 plies minimum.

G. Baltic Birch Plywood: HPVA HP-1 Grade BB; veneer core, type of glue recommended for application, suitable for transparent finish, including edges.
   1. Alternative grading standard: GOST3916.1-96 Grade II.

H. Plywood for Supporting Substrate at Countertops: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
   1. Marine grade plywood meeting BS 1088, 3/4 inch thick at areas with sinks.

I. Particleboard: Composed of wood chips, medium density, with waterproof resin binders; of grade to suit application; sanded faces; complying with ANSI A208.1. Grade 3M, bade with binder containing no added urea formaldehyde.

J. Hardboard: ANSI A135.4Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

K. MDF: Medium-density fiberboard complying with ANSI A208.2 and NAAWS requirements for Custom Grade architectural woodwork; minimum Grade 130; NAF resin.

L. Hardboard Pegboard (WD-2): ANSI A135.4Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S).
   1. Thickness: 3/16 In. thick.
   2. Perforations: 9/32 inch holes, 1 inch on center, starting 1/2 inch from the edges.
   3. Color: White.
   4. Furring: as required for peg accessory function

M. Thin CLT panels (WD-1):
   1. Basis of Design: Torzo Surfaces, Striata Series
   2. Construction: layered Douglas Fir veneer face(s) with plywood backing or core.
      a. 3-ply with two veneer faces and plywood core: Striata 360 (WD-1A)
      b. 2-ply with one veneer face and plywood backing: Striata Surface (WD-1B and WD-1C)
   3. Thickness:
      a. WD-1A: 3/4 inch

b. WD-1B: 3/4 inch
c. WD-1C: 1/4 inch
4. Panel Size: 48 by 96 inches (WD-1A), and 47 by 95 inches (WD-1B and WD-1C)
5. Finish: transparent, UV-resistant, protective finish, as described in SHOP FINISHING section.

N. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry unless otherwise indicated.

O. Hardwood Lumber: (WDB-1): NHLA FAS
1. Maple, plain sliced, Grade A.
2. Maximum moisture content: 9 percent.
3. Finger jointing: not allowed
4. Face surface: Smooth, eased edges.
5. Finish: transparent stain to match WD-1, UV-resistant, protective finish, as described in SHOP FINISHING section.
6. Dimensions: as indicated in Drawings.
7. Matching: selected for compatible grain and color.

2.03 SOLID SURFACE MATERIALS

A. Manufacturers:
1. Wilsonart (Basis of Design)
2. Formica
3. LG Hausys
4. Avonite

B. Flat Sheet Thickness: 1/2 inch, minimum for countertops. 1/4 inch for wall panel applications.

C. 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.

2.04 SHOP TREATMENT OF WOOD MATERIALS

A. The provisions of International Building Code Section 803 shall limit the allowable fire performance and smoke development of interior wall and ceiling finish materials based on occupancy classification.

B. Provide UL (DIR) listed and approved identification on fire retardant treated material.

C. ASTM E84 classifies Class A, B, and C materials by flame spread rating. The flame spread rating for each material classification is as follows:
1. Surface Burning Characteristics: Where Class A finishes are required provide products with flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
2. Surface Burning Characteristics: Where Class B finishes are required provide products with flame spread index of 26-75, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
3. Surface Burning Characteristics: Where Class C finishes are required provide products with flame spread index of 75-200, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

D. Substrates and blocking are to comply with the flame spread rating of the interior finish utilized.

2.05 SHOP FINISHING

A. Sand work smooth and set exposed nails. Prepare WD-1 per Manufacturer's written instructions.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
1. Transparent Finish:
a. Where stain is not required skip to Sealer Coat.
b. Stain: Semi-Transparent, Water-BasedUse on new/unfinished surfaces.
1) Sherwin-Williams Sher-Wood® Water Reducible Wiping Stain. To match WD-1.
2) Sealer: As recommended by the manufacturer.
3) 1st Finish Coat: match Topcoat.
4) 2nd Finish Coat: match Topcoat.
c. Transparent Varnish Topcoat:
1) System - 11, Polyurethane, Catalyzed.

2) Sheen: Satin. Satin, 31-45 glass units measured on 60 degree gloss meter per ASTM D523.
3) Products:
(a) Sherwin-Williams Sayerlack Premium Polyurethane Clear Topcoat, TZL71 Series, AWI Finishing System 11: www.sherwin-williams.com/#sle.

2.06 SITE FINISHING

A. Stain and Varnish Materials: In compliance with AWMAC/WI (NAAWS), unless noted otherwise.
B. Touch Up Materials: Provide touch up materials compatible with shop applied finishes.

2.07 GENERAL MATERIALS AND ACCESSORIES

A. Solid Surface Countertop Adhesives: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A136.1-1967 and UL listed.
B. Solid Surface Joint Adhesive: Manufacturer's standard two part adhesive kit to create inconspicuous, non-porus joints.
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. Concealed Joint Fasteners: Threaded steel.
F. Sealant for Use in Casework, Millwork and Countertop Installation:
1. Manufacturer's recommended type.
2. One component, clear silicone base sealant, chemical curing complying with ASTM C920, Type S, Grade NS, Class 25, Use NT, when tested to glass and aluminum, anti-fungus, mildew-resistant composition.

2.08 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware: BHMA A156.9, types as indicated for quality grade specified.
B. Adjustable Shelf Supports: Standard side-mounted system using double pin (5mm), heavy duty, injected molded clear plastic SC240 shelf supports for 32mm hole spacing, with hold-down tabs for 3/4 inch and 1 inch thick shelves, for nominal 1 inch spacing adjustments.
1. Load raiting: minimum 200 pounds for set of four.
C. Cabinet Locks: Provide locks on casework drawers and doors where indicated. Lock with 5 pin cylinder and 2 keys per lock.
1. Hinged Doors (Single): Single retractable cam type lock, mounted to interior surface. Provide strike-plate as required by cabinet construction. Product shall be similar and equal to Timberline 240 series Door Lock by CompX Security Products; www.compx.com, 625 finish.
2. Hinged Doors (Double): Double retractable cam type lock, mounted to interior surface, locking two adjacent doors without the need for a separate catch on the opposite door. Provide strike plates as required by cabinet construction. Product shall be similar and equal to Timberline 250 series Double Door Lock by CompX Security Products; www. compx.com, 625 finish
3. Tall Hinged Doors: Three-point latching system.
4. Provide removable core system with control key for re-keying of locks without removal of lock body.
a. Provide manufacturer's standard re-keying kit.
5. Keying: Key locks alike within a space; key each room separately.
6. Master Key System: All locks operable by master key.
D. Hinges: European style concealed soft closing / self closing, 110 degree opening type, BHMA No. A156.9, Type B01602, steel with satin finish.
1. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
2. Basis of Design: Salice, Salentia 700 Series. 100 degree opening with soft close.
E. Pulls: Brushed nickle decorative design, 7 inches wide.
1. Pull design to comply with project's referenced accessibility requirements.
2. Basis of Design: Richelieu, Modern Metal Pull, 2598
F. Heavy Duty Drawer Slides:
1. Side Mounted Slides:
a. Type: Full extension.
b. Static Load Capacity: Heavy Duty grade.
c. Features: Provide soft closing / self closing type. type.
d. Sizes: Provide products approved for use with drawer widths.
1) For drawers up to 24 inches wide: 150 pound load rating.
2) For drawers over 24 inches wide: 200 pound load rating
e. Manufacturers: provide all slides from same manufacturer

1) Accuride International, Inc; Heavy-Duty Drawer Slides: www.accuride.com.
(a) For drawers up to 24 inches wide: 3832EHDSC self close.
(b) For drawers over 24 inches wide: 3932EC easy close.

2. Flat/Under Mount Slides:
a. Type: Full extension.
b. Static Load Capacity: Heavy Duty grade.
c. Features: Provide soft closing / self closing type. type.
d. Sizes: Provide products approved for use with drawer widths.
e. Load Capacity: 150 pound minimum load rating.
f. Manufacturers: provide all slides from same manufacturer
1) Accuride International, Inc; Heavy-Duty Drawer Slides: www.accuride.com: 7957 Heavy Duty with Lever Disconnect

G. Metal Strip for Wood Stair Nosing
1. Stainless steel stair tread insert strips, three per stair nose, installed to rest at 2mm above step surface.
2. Constructed from non corrosive material, aluminum finish.
3. Size: 3 by 12 millimeters.
4. Fastening: adhesive
5. Basis of Design: Studmarc Stainless Steel Stair Tread Inserts.

2.09 COUNTERTOP BRACKETS AND ACCESSORIES

A. Steel Counter Brackets: Fixed, L-shape, powder coated steel brackets, pre-drilled for face-of stud mounting.
1. Material: Steel, pre-drilled for laterial attachement to studs.
2. Finish: Manufacturer's standard, factory-applied powder coat.
3. Color: White.
4. Load Capacity: minimum 1,800 poounds per pair. Provide double stud blocking as indicated by Manufacturer to achieve load capacity.
5. Size: as required to support countertops indicated.
6. Products:
a. A&M Hardware, Inc; Concealed Flat Brackets CFLAT series: http://www.aandmhardware.com.

B. Steel ADA Sink Counter Brackets: 12 gage, steel brackets, in profile to meet required clearances for installation of ADA counter top and removable face panel.
1. Location: ADA sinks.
2. Basis-of-Design Product: A&M Hardware ADA (23) Support Brackets.
a. Millworker fabricated particle board brackets will be rejected.
3. Load Capacity: Recommended by manufacturer for loading of 1,600 pounds per pair, minimum.
4. Material: Steel.
5. Color: Black.

C. Power Modules: Power units provided by the millworker and installed by the electrical contractor, coordiante with electrical drawings. Millworker to provide cut openings in the casework, millwork, and/or countertops.
1. Basis of Design: ByrneMhoB: www.byrne.com.
2. Module Style: In Surface pop-up.
3. Color: Gloss White, powder coated aluminum house and grommet.
4. Configuration: 4 window unit with 2 power and 2 data.
5. Hardwired, UL listed. Coordinate with Electrical Drawings.

2.10 CASEWORK, GENERAL

A. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
1. Base Cabinets: 24 inches.
2. Tall Cabinets: 24 inches.
3. Wall Cabinets: 14 inches.

B. Casework Construction Type: WD-1, Type A - Frameless.
1. Cabinet Style: Flush overlay.
a. Cabinet Doors and Drawer Fronts: Flush style.
b. Grained Face Layout for Cabinet and Door Fronts: Flush panel.

1) Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.

c. Door and Drawer Front Edge Profiles: Square edge, finished per Manufacturer's written instructions..

d. Door and Drawer Front Retention Profiles: Fixed panel.

2.11 CASEWORK FACE AND FINISHED INTERIOR CONSTRUCTION

A. Thin CLT Cabinets (WD-1)

1. End Panels: 3/4 inch WD-1B at exposed edges.
2. Flush Doors: 3/4 inch WD-1A.
3. Drawer Fronts: 3/4 inch WD-1A.
4. Sink Base Apron and False Front Faces: (WD-1B)
5. Finished Interior Cabinets:
   a. Bottoms at Base Cabinets: 3/4 inch WD-1B, bored, doweled, and glued to end panels.
   b. Bottoms and Tops of Wall Cabinets: 3/4 inch WD-1A, bored, doweled, and glued to end panels.
   c. Horizontal Top Frame: 3/4 inch thick by 5 inch wide WD-1B, front and back. For cabinets over 36 inches wide provide four-sided frame, with tenoned and glued corners. Top frame shall be bored, doweled, and glued to end panels.
   d. Anchor Strips: 5 inches wide, full depth of back recess, full width, top and bottom, securely glued.
      1) Mechanically fastened to top frame @ 4 inches on center.
      2) Provide intermediate anchor strip for cabinets over 60 inches tall.
   e. Fixed Shelves: 3/4 inch WD-1A, bored, doweled, and glued to end panels, and mechanically fastened to back panel.
   f. Adjustable Shelves: 3/4 inch WD-1A
6. Drawer Boxes:
   a. Front, back, and sides: Two bonded layers of 1/4 inch WD-1C of height filling the opening to the greatest extent possible, while remaining fully functional. Sides shall have smooth, slightly radiused top edge. No edge banding is required. Boxes shall be assembled with dovetailed construction on all corners.
   b. Bottoms: Two bonded layers consisting of 1/4 inch WD-1C and 1/4 inch plywood, captured in dado all four sides and further secured with a continuous bead of hot-melt adhesive on bottom. Omit adhesive that interferes with hardware. Particleboard, metal or plastic drawer boxes or bottoms are not acceptable.
   c. Finish wood components with two coats of clear varnish per Shop Finishing section above.
   d. Separate Subbases: 3/4 inch thick water resistant plywood, constructed to form ladder-syle base full width of cabinet, and depth as required to form 2 inch recessed toekick at front face. At exposed ends hold back 1/4 inch to form recess for application of base indicated.
      1) Where base is required to be open for ventilation, construct pallet-style base, open front and back, with ventilated front as indicated.
   e. Filler Strips and Panels: Provide full height/width/depth filler strips and panels, matching case construction, as follows:
      1) As indicated in elevations, or as otherwise required to fill gaps at ends abutting other construction.
      2) At exposed ends where cabinets are furred out from other construction.
      3) Horizontal panels completely filling gaps and corner voids at top and bottom of cabinets not otherwise concealed by surrounding construction.
      4) Provide removable front panels matching door construction for attachment to under-sink brackets at ADA knee spaces or as otherwise indicated on elevations.
   f. Exposed Edge Treatment: WD-1 finished per Manufacturer's written instructions.

2.12 CABINET FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Construction: As required for selected grade, and not less than indicated elsewhere in this section.

C. Structural Performance: Safely support the following minimum loads:

1. Base Units: 500 pounds per linear foot across the cabinet ends.
2. Suspended Units: 300 pounds static load.
3. Standard Drawers: Heavy Duty - 100 pounds static load, minimum.
4. File Drawers: Heavy Duty - 150 pounds static load, minimum.
5. Hanging Wall Cases: 300 pounds.
6. Shelves: 100 pounds, minimum.

D. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.

1. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

E. Hardware Application: Factory-machine casework members for hardware that is not surface applied.

F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs. Seal cut edges at plumbing fixtures.

G. Access Panels: Where indicated, for maintenance of utility service and mechanical and electrical components.

H. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

I. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

J. Apron Frames: Construction similar to other cabinets, with modifications.

1. Frames fabricated from panels standard with the manufacturer. Include front and back panels, with drawer suspension framing mechanically fastened to support channels spanning between them.

2.13 COUNTERTOPS AND WINDOW STOOLS, GENERAL

A. Quality Standards:

1. Fabricate in accordance with AWMAC/WI (NAAWS), Section 11 - Countertops.
   a. Premium Grade: Includes Solid Surface countertops.

B. Back and End Splashes: Same material, same construction; minimum 4 inches high unless noted otherwise.

2.14 COUNTERTOPS

A. Solid Surface Countertops and Stools: Solid surfacing sheet or plastic resin casting self-supporting over 3/4 inch plywood structural members.

1. 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. Flat Sheet Thickness: 1/2 inch, minimum.
   b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   c. Surface Color and Pattern: As indicated on drawings.
2. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
3. Other Components Thickness: 1/2 inch, minimum.

2.15 COUNTERTOP FABRICATION

A. Fabricate in accordance with manufacturer's standard requirements.

B. 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, and not more than 1/8 inch at appliances.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

C. 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.

D. 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.

E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

2.16 WOOD BENCH AND SOCIAL STAIR ELEMENTS

A. Thin CLT Type WD-1B:

1. Maximum moisture content: 9 percent.
2. Finger Jointing: not allowed.
3. Face Surface: smooth, eased edges.
4. Finish: Stained to Match architect’s sample; Class A Transparent Clear, UV-resistant, protective finish, as described in Section 2.07 SHOP FINISHING by Millworker
5. Dimensions: As indicated in Drawings.
6. Matching: Selected for compatible grain and color.
7. Accessories: Nosing Trim at stair nosing.

2.17 WOOD TRIM

A. Hardwood Lumber Trim Type WDB-1:
   1. Species and Grade: Plain Sliced Maple, Grade A.
   2. Maximum moisture content: 9 percent.
   3. Finger Jointing: Not allowed.
   4. Face Surface: Smooth, eased edges.
   5. Finish: Stained to Match architect's sample; Class A Transparent Stain to match WD-1, UV-resistant, protective finish, as described in SHOP FINISHING section by Millworker
   6. Dimensions: As indicated in Drawings.
   7. Matching: Selected for compatible grain and color.

PART 3 EXECUTION

3.01 PREPARATION

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

B. Protect adjacent finishes during millwork, casework, and countertop installation.

3.02 GENERAL

A. Examination:
   1. Site Verification of Environmental Conditions:
      a. Comply with requirements of referenced quality standard ambient relative humidity during fabrication and in installation areas.
      b. Do not deliver casework and millwork until the following conditions have been met:
         1) Building has been enclosed (windows and doors sealed and weather-tight).
         2) An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
         3) Ceiling, overhead ductwork, piping, and lighting have been installed.
         4) Installation areas do not require further "wet work" construction.
   2. For Base Cabinet, Millwork, and Countertop Installation: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 1/2 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.
   3. For Wall Cabinet and Millwork Installation: 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 ft and 1/2 inch in 20 ft 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: 1/8 inch in 10 feet in any direction.
   4. Verify adequacy of backing, support framing, and anchors.
   5. Verify location and sizes of utility rough-in associated with work of this section.
   6. Starting installation of casework and millwork implies conditions are acceptable for work of this section.

B. Installation:
   1. Install work in accordance with AWMAC/WI (NAAWS) requirements for grade indicated, including "Installation Supplement".
   2. 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.
   3. Set and secure cabinet and millwork in place, assuring that they are rigid, plumb, level, and securely anchored to building structure. Provide concealed reinforcement at gypsum board assemblies.
   4. Use concealed joint fasteners to align and secure adjoining cabinet units.
   5. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
   6. 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:
   7. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
   8. Variation of Bottoms of Wall Cabinets from Level: 1/8 inch in 10 feet.
   9. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
   10. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
   11. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

12. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
13. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
14. Base and Tall Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 24 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
15. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches on center, and at sides of cabinets with not less than two fasteners per side.
16. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 24 inches on center.
17. Install hardware uniformly and precisely.

3.03 COUNTERTOPS

A. Examination:
1. Do not begin installation until substrates have been properly prepared.
2. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
3. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

B. Preparation:
1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Installation:
1. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
2. Seal joint between back/end splashes and vertical surfaces.

D. Tolerances:
1. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
2. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
3. Overhangs: 1/8 inch in 8 feet, maximum.
4. Field Joints: 1/8 inch wide, maximum.

3.04 WOOD BASE

A. Installation:
1. At Masonry Walls: Secure wood base to masonry substrate with concealed mechanical fasteners suitable for substrate, supplemented with construction adhesive. Space fasteners as required to maintain continuous, tight contact with substrate and prevent movement, warping, or separation. Countersink fasteners and fill holes to match adjacent finished wood. Do not install exposed fasteners.
2. At Gypsum Walls: Secure wood base to gypsum substrate with concealed mechanical fasteners suitable for substrate. Space fasteners as required to maintain continuous, tight contact with substrate and prevent movement, warping, or separation. Countersink fasteners and fill holes to match adjacent finished wood. Do not install exposed fasteners.

3.05 ADJUSTING

A. Test installed work for rigidity and ability to support loads.

B. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion; replace units that cannot be repaired to like-new condition.

3.06 CLEANING

A. Do not permit finished casework, millwork, and countertops to be exposed to continued construction activity.

B. Protect casework, millwork and countertops from ongoing construction activities. Protect countertop surfaces with Masonite. Prevent workmen from standing on, or storing tools and materials on casework or countertops.

C. Clean casework and millwork including but not limited to countertops, shelves, drawers (including behind drawers), hardware, fittings, and fixtures.

3.07 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

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SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in exterior wall construction.

B. Foamed-in-place insulation for filling perimeter window and door shim spaces.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Laminated construction panels with integral insulation.

B. Section 07 2700 - Air Barriers: Separate air barrier materials.

1.03 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.

1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2025.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.

F. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

1.06 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Evaluated Materials Program (EAP); www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.07 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. The following is intended as a summary of potential applications where not specifically indicated, but may not represent all of the applications required to complete the work. The Specifications and the remainder of the construction documents are complimentary, as additional applications may be indicated throughout.

B. Insulation Over Metal Stud Framed Walls, Continuous: Continuous insulation composite panels.

C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

D. Filling perimeter window and door shim spaces: Foamed-in-place

E. Insulation in iterior stud walls where Acoustic Batts are indicated: Refer to Section 09 2116.

2.02 FOAM BOARD INSULATION MATERIALS

A. Continuous insulation composite panels:

2.03 MINERAL FIBER BOARD INSULATION MATERIALS

A. Mineral Wool Block, Board, or Blanket Thermal Insulation: Complying with ASTM C612 or ASTM C553.

1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
2. Board Size: as required for friction fit into construction or abutted to form continuous layer.
3. Board Thickness: as indicated.
4. Thermal Resistance: R-value of 4.2 per inch at 75 degrees F, minimum, when tested in accordance with ASTM C518.
5. Water vapor permeance: 25 minimum in accordance with ASTM E96/E96M.
6. Moisture sorbtion: 1% maximum in accordance with ASTM C1104.
7. Fungi resistance: Zero mold growth in accordance with ASTM C1338.
8. Corrosive resistance: Non-corrosive in accordance with ASTM C665.
9. Products:
    a. Johns Manville: www.jm.com.
    b. ROXUL, Inc; www.roxul.com.
    c. Other manufacturers demonstrating compliance with Specifications and Basis-of-Design product.

2.04 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.

1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Thermal Resistance: R-value of 4 per inch.
3. Batt Size: as required for friction fit into construction or abutted to form continuous layer.
4. Thickness: as indicated.
5. Density: 2.5 pounds per cubic foot.
6. Products:
    a. Johns Manville: www.jm.com.
    b. ROXUL, Inc: www.roxul.com.
    c. Other manufacturers demonstrating compliance with Specifications and Basis-of-Design product.

2.05 FOAMED-IN-PLACE INSULATION

A. Medium-Density, rigid or semi-rigid, closed-cell polyurethane foam; foamed on-site, using blowing agegnt of water or non-ozone depleting gas.

1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
    a. Fire Protection: Provide 15-minute thermal barrier of 1/2 inch gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
2. Thermal Resistance: R-value of 6.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
4. Water Absorption: Less than 2.5 percent by volume, maximum, when tested in accordance with ASTM D2842.
5. Air Permeance: 0.004 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf.
6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

A. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
   1. Width: 3-1/2 inches.
   2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

B. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

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 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2500 - WEATHER BARRIERS

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Water-resistive barriers.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

2.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Composite insulation sheathing panels to receive weather barrier.

2.03 DEFINITIONS

A. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders or vapor barriers.

B. Vapor Barrier: Air tight barrier made of material that is water vapor impermeable, with sealed seams and with sealed joints to adjacent surfaces.

2.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

D. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).

2.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

2.06 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.
2. 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.

2.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

3.01 WEATHER BARRIER ASSEMBLIES

A. The following is a general summary of weather barrier system types required and locations where they are to be applied, unless otherwise indicated.

B. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

1. Use weather-resistive barrier, composite unless otherwise indicated.

C. Air Barrier:

1. On outside surface of sheathing of exterior walls use air barrier sheet, self-adhesive type.

3.02 AIR BARRIER (ALSO ACTING AS WATER-RESISTIVE BARRIER, VAPOR OPEN) (AB-)

A. Air Barrier Sheet, Self-Adhered: (AB-S)

1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
4. 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.
5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
6. Manufacturers:
   a. Henry Company; Blueskin VP160: www.henry.com.
   b. VaproShield, LLC; WrapShield SA - Self-Adhered: www.vaproshield.com.
   c. Substitutions: See Section 01 6000 - Product Requirements.

3.03 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

B. Flexible Flashing: Self-adhering or mechanically attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.

C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.

D. Seam and Perimeter Tape: Polyethylene face material with acrylic adhesive.

E. Sheet Membrane Mounting Tape: Double-sided strip of pressure-sensitive, acrylic adhesive reinforced with embedded fiber-strand carrier layer and plastic backing.

F. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

4.02 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.

4.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Vapor Retarders and Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

E. Openings and Penetrations in Exterior Water-Resistive Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings filled 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 wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

4.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.

1. Allow access to work areas and staging.
2. Notify Owner's testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
3. Do not cover work of this section until testing and inspection is accepted.

C. 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.

D. Do not cover installed water-resistive barriers until required inspections have been completed.

E. Take digital photographs of each portion of installation prior to covering up weather barriers.

4.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION {CH#10000624}

SECTION 07 4213 - METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, with insulation, related flashings, and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wall panel substrate.
B. Section 07 2100 - Thermal Insulation.
C. Section 07 2500 - Weather Barriers: Water-resistive barrier under wall panels.
D. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.
C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, _____, and methods of anchorage.
D. Samples: Submit two samples of wall panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.
E. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum five years of documented experience and approved by manufacturer.

1.06 MOCK-UPS

A. Construct mock-up, 10 feet long by 4 feet wide; include panel system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.
B. Locate where directed by Architect.
C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: ATAS International, Inc; Dutch Seam Wall Panel: www.atas.com

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior wall panels.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Design Pressure: In accordance with applicable codes.
   4. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
   5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

B. Exterior Wall Panels:
   1. Profile: Vertical.
   2. Color: Dark Bronze.

C. Trim, Closure Pieces, Caps, and Flashings: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

D. Anchors: Galvanized steel or Stainless steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer’s standard line.

2.05 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Concealed Sealants: Non-curing butyl sealant or tape sealant.

C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
   1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

3.03 INSTALLATION

A. Install panels on walls in accordance with manufacturer's instructions.

B. Fasten panels to structural supports; aligned, level, and plumb.

C. Locate joints over supports.

D. Provide expansion joints where indicated.

E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 5300 - ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane application.
B. Insulation, flat and tapered.
C. Vapor retarder.
D. Cover boards & substrate boards.
E. Flashings.
F. Roofing stack boots and walkway pads.
G. Roof pavers systems.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings.
C. Section 22 1006 - Plumbing Piping Specialties: Roof drains.

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. 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 C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
E. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
H. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
I. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.
J. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2020).
K. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2024.
L. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).
M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
N. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
O. FM (AG) - FM Approval Guide; Current Edition.
P. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2026).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

A. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, and fasteners.
B. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and walk pad layout.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
D. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.
B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a two year period after Date of Substantial Completion.
C. Provide thirty year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
   1. Carlisle SynTec Systems; Sure-Tough EPDM: www.carlisle-syntec.com.
   2. GenFlex Roofing Systems, LLC: www.genflex.com.
   3. Johns Manville; JM EPDM: www.jm.com.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.
B. Roofing Assembly Requirements:
   1. Insulation Thermal Resistance (R-Value): 4 per inch, minimum.
C. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-monomer (EPDM); internally reinforced with fabric or scrim; complying with minimum properties of ASTM D4637/D4637M.
   1. Thickness: 90 mil, 0.090 inch, minimum.
   2. Sheet Width: 76 inches, maximum.
   3. Color: Black.
   4. Ultimate Elongation: 480 percent, minimum, measured in accordance with ASTM D412.
   5. Durometer Hardness, Type A: 30, minimum, in accordance with ASTM D2240
   6. Tear Strength: 210 lbf per inch, measured in accordance with ASTM D624.
   7. Water Vapor Permeability: .02 perm inch, measured in accordance with ASTM E96/E96M.
   8. Brittleness Temperature: -45 degrees F, measured in accordance with ASTM D746.
B. Seaming Materials: As recommended by membrane manufacturer.
C. Vapor Retarder: Plastic, complying with requirements of fire rating classification; compatible with roofing and insulation materials.
   1. Fire-retardant adhesive.
D. Flexible Flashing Material: Same material as membrane.

2.04 DECK SHEATHING

A. Deck Sheathing: Gypsum sheathing, ASTM C1396/C1396M, Type X special fire resistant type, paper face, 1/2 inch thick.

2.05 COVER BOARDS

A. Cover Boards: Faced and with high compressive strength polyisocyanurate (ISO) insulation complying with ASTM C1289.
   1. Classifications:
      a. Type II - Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
   2. Board Size: 48 by 96 inches.
   3. Board Thickness: 1/2 inch.

4. Thermal Resistance at 1/2 inch Thick, R-value: 2.0.

2.06 INSULATION

A. Expanded Polystyrene (EPS) Board Insulation: Complying with ASTM C578, with drainage channels on one face.
   1. Board Size: 48 by 96 inches.
   2. Board Thickness: 2 inches.
   3. Board Edges: Square.
   4. Type and Board Density: Type XI, 0.70 lb per cu ft (12 kg/cu m), minimum.
   5. Type and Compressive Resistance: Type XI, 5 psi (35 kPa), minimum.
   6. Type and Thermal Resistance, R-value: Type II, 4.0 (0.70) per 1 inch thickness at 75 degrees F mean temperature using ASTM C177 test method.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 1 - Non-reinforced core foam.
         2) Compressive Strength: 16 psi, minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0 at 75 degrees F.
   2. Board Size: 48 by 96 inches.
   3. Board Thickness: 0.5 inch.

2.07 ACCESSORIES

A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.

B. Roofing Expansion Joint Flashing: Sheet butyl.

C. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials ; cants formed to 45 degree angle.

D. Sheathing Adhesive: Noncombustible type, for adhering gypsum sheathing to metal deck.

E. Sheathing Joint Tape: Paper type, ___ inches wide, self adhering.

F. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

G. Insulation Fasteners: Appropriate for purpose intended.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

H. Membrane Adhesive: As recommended by membrane manufacturer.

I. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

J. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

K. Insulation Adhesive: As recommended by insulation manufacturer.

L. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.

M. Insulation Perimeter Restraint: Stainless steel edge device configured to restrain insulation boards in position and provide top flashing over ballast.

N. Sealants: As recommended by membrane manufacturer.

O. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Asphaltic with mineral granule surface.
   2. Size: As indicated on drawings.
   3. Products:
      a. W.R. Meadows, Inc; Whitewalk: www.wrmeadows.com.
      b. W.R. Meadows, Inc; Duo-Pad: www.wrmeadows.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - WOOD DECK

A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

3.03 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck.
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
   2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
   3. Tape joints.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

H. Do not apply more insulation than can be covered with membrane in same day.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate of ___ gal per 100 sq ft. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Install roofing expansion joints where indicated. Make joints watertight.
   1. Install prefabricated joint components in accordance with manufacturer's instructions.

H. Coordinate installation of roof drains and sumps and related flashings.

3.06 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 07 7100 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.

C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

F. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

I. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

J. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2012.

K. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

L. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2013a.

M. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).

N. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

O. CDA A4050 - Copper in Architecture - Handbook; current edition.

P. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1. Copies of Architect's Drawings, manufacturer's standard details or other non-project-specific details are not acceptable, and will be returned without review.

C. Samples: Submit two samples 2 by 3 inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim Manufacturers:
   1. ALUCOBOND USA; ALUCOBOND AXCENT: www.alucobondusa.com.
   2. Fairview Architectural LLC: www.fairview-na.com.
   3. Hickman Edge Systems: www.hickmanedgesystems.com.

2.02 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with fluoropolymer coating.
   1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: Match adjacent copings, fascias, and gravel stops. See Section 07 7100 - Roof Specialties.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
G. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.04 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.
B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.
C. Slip Sheet: Rosin sized building paper.
D. Primer: Zinc chromate type.
E. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.
F. Concealed Sealants: Non-curing butyl sealant.
G. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
H. Plastic Cement: ASTM D4586/D4586M, Type I.
I. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.
B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Insert flashings into cut reglets to form tight fit; secure in place with stainless steel spring wedges; seal flashings into reglets with sealant.
B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

END OF SECTION

SECTION 07 7123 - MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gutters and downspouts.
B. Splash guards.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.
B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.
C. CDA A4050 - Copper in Architecture - Handbook; current edition.
D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on prefabricated components.
C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
D. Samples: Two sample assemblies, 12 inches long, illustrating component design, finish, color, and configuration.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Stack material to prevent twisting, bending, or abrasion and to provide ventilation. Slope to drain.
C. Prevent contact with materials that cause discoloration, staining, or damage.

1.06 WARRANTY

A. Manufacturer Warranty: Provide 5-year manufacturer warranty for material and workmanship. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by storm occurrence of 1 in 5 years.

2.02 GUTTERS AND DOWNSPOUTS

A. Gutters: SMACNA (ASMM) rectangular profile.

2.03 SPLASH GUARDS

A. Splash Pans: Same metal type as downspouts, formed to 12 by 18 inches in size; rolled sides 1 inch high for inverted pan placement.

2.04 SHOP FABRICATION

A. Form gutters of profiles and size indicated in construction documents.
B. Fabricate with required connection pieces.
C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints; comply with CDA A4050
D. Hem exposed edges of metal.
E. Fabricate gutter accessories; seal watertight.

2.05 FINISHES

A. Prefinished Aluminum Sheets: Factory-applied topcoat systems applied to aluminum flat sheet substrates prior to fabrication by coil coating; topcoat systems consist of primers and organic topcoats on exposed side and backing coats on unexposed side.

1. Superior Performance Organic Coating System: Comply with AAMA 2605 for aluminum preparation, pretreatment, primer, and finish coat system; provide thermally cured 70-percent PVDF fluoropolymer systems; tested for weathering for 10 years with 5 delta units color change maximum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 1/4 inch per 10 feet, minimum.

END OF SECTION

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

H. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
7. Sample product warranty.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Selection Samples: For each finish where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available colors.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.

1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
2. Pecora Corporation: www.pecora.com.
3. Sika Corporation: www.usa-sika.com.
4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
   a. Wall expansion and control joints.
   b. Joints between door, window, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. Other joints indicated below.

B. Type JS-1 - Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

C. Type JS-3 - Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Type JS-4 - Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Type JS-1 - Wall and Ceiling Joints in Wet Areas (to be Painted): Non-sag polyurethane sealant for continuous liquid immersion.
3. Type JS-2 - Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
4. Joints in tile: See Section 09 3000 - Tiling.

D. Interior Wet Areas: where sink is indicated in drawings; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

F. Areas Where Tamper-Resistance is Required: As indicated on drawings.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Where changes in finished surface or color warrant a change in sealant color to maintain design intent, provide multiple colors required, and install as indicated in PART 3 below.

C. Sealants appplied for bedding of door/window sills, "internal" joints in wall or floor construction, or other locations concealed by finished work need not be of any specific color. Manufacturer's "transition runs", overruns, or other such off-color products may be used at these locations so long as manufacturer certifies products meet specified perfomance requiremements.

2.04 NONSAG JOINT SEALANTS

A. Type JS-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: To be selected by Architect from manufacturer's full range.

B. Type JS-2 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: Clear.

C. Type JS-3 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's full range.

D. Type JS-4 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.

E. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
   1. Prime surfaces and fully dry/cure prior to installation of backing.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 07 9513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.

D. ITS (DIR) - Directory of Listed Products; Current Edition.

E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

1. Copies of Architect's Drawings, manufacturer's standard details or other non-project-specific details are not acceptable, and will be returned without review.

D. Samples for Color Selection: Submit two sample sets illustrating manufacturer's full line of color options for exposed resilient components. Proposed products shall have similar array of color options as Basis-of-Design products.

1. Where changes in finished surface or color warrant a change in joint color to maintain design intent, provide multiple colors required.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:

1. Architectural Art Mfg, Inc: www.archart.com/#sle.
2. Construction Specialties, Inc: www.c-sgroup.com. (Basis-of-Design)
3. EMSEAL Joint Systems, Ltd: www.emseal.com/#sle.
4. Inpro: www.inprocorp.com/#sle.
5. MM Systems Corp: www.mmsystemscorp.com.
6. Nystrom, Inc: www.nystrom.com/#sle.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Provide manufacturer's fire rated version of joint type indicated where applicable, including all recommended accessories.

1. Coordinate inspection of fire rated joints with requirements of Section 07 8400 - Firestopping.

B. Interior Floor Joints Subject to Thermal Movement: Construction Specialties, GFT, at locations indicated and as detailed on drawings.

1. Manufacturers:
   a. Balco, Inc; No-Bump Floor to Floor System, Aluminum (NBAF): www.balcousa.com/#sle.
   b. Construction Specialties, Inc; Allway Standard Metal Floor Covers: www.c-sgroup.com/#sle.
   c. Watson Bowman Acme Corporation; Wabo CorridorWrap Floor: www.watsonbowmanacme.com/#sle.

C. Interior Wall/Ceiling Joints Subject to Thermal Movement: Construction Specialties, AFW, at locations indicated and as detailed on drawings

1. Manufacturers:
   a. Balco, Inc; Wall and Ceiling Snap-On Joint Cover (WD): www.balcousa.com/#sle.
   b. Construction Specialties, Inc; Allway Standard Wall and Ceiling Covers: www.c-sgroup.com/#sle.

D. Exterior Wall Joints Subject to Thermal Movement: Silicone-faced pre-compressed foam.
   1. Manufacturers:
      a. Balco, Inc; Foam Seal System (BCSW): www.balcousa.com/#sle.
      b. Construction Specialties, Inc; VF Series: www.c-sgroup.com/#sle.
      c. EMSEAL Joint Systems, Ltd; Colorseal System: www.emseal.com/#sle.

2.03 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Joint Cover Styles: As indicated on drawings.
   4. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   5. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.
   1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
   2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.

C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt (unless otherwise indicated); designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.

D. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
   1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
   1. Exposed Finish Outdoors: Natural anodized.
   2. Exposed Finish at Floors: Natural anodized.
   3. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:
   1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
   2. For Pedestrian Traffic Applications: EPDM rubber, Neoprene, or Santoprene; no PVC; Shore A hardness of 40 to 50 Durometer.
   3. Color: to be selected from manufacturer's full range

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.05 ACCESSORIES

A. Factory Fabricated Transitions: Provide manufacturer recommended factory-fabricated transitions for planar offsets or directional changes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Do not permit traffic over unprotected floor joint surfaces.

B. Provide strippable coating to protect finish surface.

END OF SECTION {CH#10000104}

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Sound-rated hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
C. Section 09 9123 - Interior Painting & Transparent Finishing: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.
B. ASCE: American Society of Civil Engineers.
C. HMMA: Hollow Metal Manufacturers Association.
D. NAAMM: National Association of Architectural Metal Manufacturers.
E. NFPA: National Fire Protection Association.
F. SDI: Steel Door Institute.
G. UL: Underwriters Laboratories.

1.04 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; 2026.
C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.
D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
G. 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; 2026.
H. 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; 2025.
I. ASTM C143/C143M - Standard Test Method for Slump of Concrete; 2026a.
J. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
L. ASTM E413 - Classification for Rating Sound Insulation; 2022.
M. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
Q. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
S. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Door and Frame Assemblies; 2013.
T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).
U. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2026.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, anchorage, joints, field splices, accessories, removable stops, glazing, and any indicated finish requirements.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
2. Republic Doors, an Allegion brand: www.republicdoor.com.
3. Steelcraft, an Allegion brand: www.allegion.com.

B. Sound-Rated Hollow Metal Doors and Frames:

1. AMBICO Limited: www.ambico.com.
2. Megamet Industries, Inc: www.megametusa.com.
3. Overly Door Company: www.overly.com.

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: Hinged edge square, and lock edge beveled.
4. Typical Door Face Sheets: Flush.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers 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.
7. Zinc Coating for Typical Interior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. 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 3 - Extra Heavy-duty.
   b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Core Material: Polystyrene.
3. Door Thickness: 1-3/4 inches, nominal.

C. Sound-Rated Interior Doors:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 50, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Thickness: As required to meet acoustic requirements indicated.
4. Opening Force of Sound-Rated Doors, Non-Fire-Rated: 5 pounds, maximum, in compliance with ADA Standards.

2.04 HOLLOW METAL FRAMES (DESIGNATED AS F ##)

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: 16 gage, 0.053 inch, minimum.

D. Sound-Rated Door Frames: Knock-down type.

1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Frame Finish: Factory primed and field finished.

E. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Frame Anchors:

1. Masonry Type: T-shaped anchors to suit frame size, 10 inches long, formed of cold rolled steel not less than 0.042 inches thick.
2. Existing Masonry Type: Snap in anchors designed for use with compression or wedge type bolt anchors through face of frame. Provide bolts with flush type heads.
3. Stud Type: Snap in or welded anchors fully engaging stud, formed of cold rolled steel not less than 0.042 inches thick.
4. Base Anchors: Provide base anchors for attachment to floor, formed of cold rolled steel not less than 0.042 inches thick.
5. Anchors shall receive manufacturer's standard zinc coating per; ASTM A653/A653M.
6. Provide three anchors per jamb for frames up to 90 inches tall. For taller frames provide four anchors per jamb.

B. Glazing: See Section 08 8000 - Glazing.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

F. 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.

G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
B. Coat inside of acoustic frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
B. Install fire rated units in accordance with NFPA 80.
C. Coordinate frame anchor placement with wall construction.
D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
E. Install door hardware as specified in Section 08 7100.
    1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
F. Comply with glazing installation requirements of Section 08 8000.
G. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.
B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION {CH#10000927}

SECTION 08 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall-mounted access units.

B. Sound-control access units.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting & Transparent Finishing: Field paint finish.

1.03 REFERENCE STANDARDS

A. 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; 2026.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

1.05 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Acoustic Units:

1. Location: As indicated on drawings.
2. Size: As indicated on drawings..
3. Door/Panel: Hinged,18 gauge, encapsulated design
   a. Acoustical barrier: 2" thick acoustical mineral liner and 0.11" thick mineral filled vinyl barrier..
4. Frame: 18 gauge flanged configuratino with 1" thick acoustical mineral liner with continuous perimeter silicone gasket.
5. Acoustic rating: STC 64.

2.02 WALL MOUNTED ACCESS UNITS

A. Manufacturers:

1. ACUDOR Products Inc: www.acudor.com.

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

SECTION 08 3613 - SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, manually and electrically operated.
B. Overhead stacking doors, manually operated.
C. Operating hardware and supports.
D. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel channel opening frame.
B. Section 06 1000 - Rough Carpentry: Rough wood blocking for door opening.
C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
D. Section 26 0583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; Current Edition.
B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL (DIR) - Online Certifications Directory; Current Edition.
F. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
    1. Copies of Architect’s Drawings, manufacturer’s standard details or other non-project-specific details are not acceptable, and will be returned without review.
C. Product Data: Show component construction, anchorage method, and hardware.
D. Samples: Submit two panel finish samples, 4 x 4 inch in size, illustrating color and finish.
E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
F. Operation Data: Include normal operation, troubleshooting, and adjusting.
G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
B. Installer Qualifications: Company specializing in performing work of type specified and with at least ten years documented experience and approved by manufacturer.
C. Comply with applicable code for motor and motor control requirements.
D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.
B. Correct defective Work within a one year period after Date of Substantial Completion.
C. Warranty: Include coverage for electric motor and transmission.

D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 SECTIONAL OVERHEAD ALUMINUM DOORS

A. Aluminum Doors: Stile and rail aluminum with glazed panels; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Basis-of-Design: Clopay Building Products; 904U: www.clopaydoor.com
   2. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
   3. Door Nominal Thickness: 2 inches thick.
   4. Thermal Transmittance: U-factor of 0.86 Btu/hr sq ft degrees F, maximum, in accordance with DASMA 102.
   5. Finish: Factory anodized; Dark bronze anodized.
   6. Electric Operation: Electric control station.

B. Door Panels: Paneled aluminum construction; extruded aluminum stiles and rails; 1/2 inch thick infill panels of Low E coated, tempered glass; stile and rail joints internally reinforced with cast aluminum bracketsand polyurethane foadm injected; rabbeted weather joints at meeting rails.

C. Glazing: Fully tempered glass; insulated; clear; 1/2 inch thick.

D. Weather-stripping: Provide complete perimeter seals. Provide flexible top seal, flexible jamb seal and U-shaped bottom seal.

E. Track:
   1. Provide track configuration to maximize headroom available per plans
   2. 2 inches (50 mm) track designed for 2” diameter rollers. Vertical tracks minimum 0.061 inch (1.55 mm) galvanized steel. Horizontal tracks minimum 0.075 inch (1.91 mm) galvanized steel.

F. Spring Counterbalance: Torsion spring counterbalance mechanism sized to weight of the door, with high strength galvanized aircraft cable with minimum 7 to 1 safety factor.
   1. Standard Cycle Spring: 10,000 cycles.

G. Manual Operation:
   1. Direct drive chain hoist with integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

2.02 STACKING OVERHEAD DOOR

A. Glazed aluminum vertically stacking overhead door with no floor or ceiling tracks. Sections stack together above opening without the need for hinges or other visible hardware connecting sections together.
   1. Basis-of-Design: Clopay Building Products; VerrtiStack Clear; www.clopaydoor.com

B. Sections:
   1. Section Construction:
      a. Sections are 2-1/8 inches (54 mm) thick extruded 6053-T5 aluminum, consisting of center stiles, end stile, intermediate rails, and top and bottom rails with glazed panels. Panel widths are equally spaced.
      b. Section rails and stiles: Polyurethane foam injected.
      c. Sections to stack above opening when door is in open position
   2. Panels/Glazing:
      a. 1/2" Insulated Tempered Low-E Clear.
   3. Factory Finish: Dark bronze anodized.

C. Wall angles:
   1. Steel wall angles, powder coated to match guide covers and bracket plates.

D. Track:
   1. Vertical continuous angle mounted, 2’’ galvanized full tapered steel track, which must not require ceiling mount.
   2. Track and rollers must be concealed by guide covers when door is fully installed.

E. Guide Covers:
   1. Steel. Install without the need for visible fasteners.
   2. Finish: Powder coat.

3. Section Locking Devices: Manually operated locking mechanism mounted on both sides of the door, positioned between wall angle and guide cover. Locks impede opening of door and/or separating of sections while door is in the closed position. Lock handles have the ability to be padlocked in place if desired.
4. Interlock: Includes interlock for use with motor to prevent operation while locked.

F. Locking:
1. Manually operated locking mechanism mounted on both sides of the door, positioned between wall angle and guide cover. Locks impede opening of door and/or separating of sections while door is in the closed position. Lock handles have the ability to be padlocked in place if desired.

G. Weatherstripping:
1. Vinyl top weather seal and reverse angle jamb weather seal.
2. Top weather seal must be affixed to top section and not at the header.

H. Spring Counterbalance:
1. Spring Balance: **:** torsion spring counterbalance mechanism sized to weight of the door.
2. Include 25,000-cycle torsion springs
3. Strap Assembly: high-strength strap assembly.

I. Brackets: Fabricate from minimum 7 gauge steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
1. Finish: Powder coat.
2. Color: As selected by Architect from manufacturer's standard color range.

J. Manual Operation:
1. Chain hoist assembly and chain hoist cover.
2. Maximum starting pull force: 25 lbs

2.03 ELECTRIC OPERATION

A. Electric Operators:
1. Mounting: Side mounted on cross head shaft.
2. 1/3 hp; manually operable in case of power failure, transit speed of 12 inches per second.
3. Motor Voltage: 120 volts, single phase, 60 Hz.
4. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
5. Controller Enclosure: NEMA EN 10250, Type 1.
6. Opening Speed: 12 inches per second.
7. Brake: Adjustable friction clutch type, activated by motor controller.
8. Manual override in case of power failure.

B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
1. 24 volt circuit.
2. Surface mounted, at interior door jamb.
3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Photoelectric sensors monitored to meet UL 325.

E. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to reverse door upon striking object; hollow rubber covered to provide weatherstrip seal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.
B. Anchor assembly to wall construction and building framing without distortion or stress.
C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
D. Fit and align door assembly including hardware.
E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
F. Install perimeter trim.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.
B. Maximum Variation from Level: 1/16 inch.
C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.
B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

A. Clean doors and frames and glazing.
B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.
B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermally-broken and non-thermally broken Aluminum-framed storefront, with glazing.
B. Aluminum doors and frames.
C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA 501.1 - Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure; 2005.
B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum; 2025.
D. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.
E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
F. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.
G. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
H. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
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; 2026.
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 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.
O. NFRC 500 - Procedure for Determining Fenestration Product Condensation Resistance Values; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
    1. Surrounding conditions shall be detailed as required to show integration of window to air/weather/vapor barriers, including accessories and products proposed, and indicating the expected order of installation. It is the responsibility of the window installer to coordinate these details with other affected trades.
    2. Copies of Architect's Drawings, manufacturer's standard details or other non-project-specific details are not acceptable, and will be returned without review.

3. Where it is infeasible to verify field dimensions prior to generating shop drawings, include letter from contractor responsible for surrounding construction stating specific reasons that field dimensions are not available, and certifying that the finished surrounding construction shall conform to the dimensional requirements and installation tolerances indicated on the shop drawings. That contractor shall become solely responsible for modifications to new or existing work required to accommodate installation per the shop drawings, to the satisfaction of the Architect, and at no additional cost to the Owner.

D. Selection Samples: For each finish where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available finishes, colors and textures.

1. Where manufacturer specific color is indicated, proposed products of other manufacturers must be available in matching color, or provide custom color to match at no additional cost. Adequacy of color matching is at the sole discretion of the Architect.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Field Inspection Reports: Reports of inspections conducted by Manufacturer's Representative.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least ten years of documented experience.

B. Manufacturer's Representative Inspections: A qualified representative of the manufacturer shall conduct inspections of the materials and workmanship, and submit a report to the Architect with written descriptions and photographs of; field conditions, compliance with storage and handling requirements, compliance with manufacturer's installation details, compliance with shop drawings, and noting anything that would adversely affect the warranty, performance, or life of the installation. Inspections shall occur as follows: at the onset of installation (less than 10 percent complete), during the installation (between 40 percent and 60 percent compete), and upon completion of the work.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience and approved by manufacturer.

1.07 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.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide ten 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 Storefront and Doors:

B. EFCO Corporation: www.efcocorp.com. (Basis-of-Design)

1. Thermally-broken: Series 403I
2. Non-thermal: Series 402

C. Kawneer North America: www.kawneer.com.

D. Oldcastle BuildingEnvelope: www.oldcastlebe.com.

2.02 ALUMINUM-FRAMED STOREFRONT - EXTERIOR

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   2. Glazing Position: Centered (front to back).
   3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   4. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   5. Finish Color: As selected by Architect from manufacturer's standard line.
   6. 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.
   7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   8. 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.
      a. Provide manufacturer's standard water deflectors where horizontal mullions frame into vertical mullions, to direct water away from edge of glazing into vertical member.
   9. 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.
   10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   12. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Positive Design Wind Load: ____ lbf/sq ft.
      b. Negative Design Wind Load: ____ lbf/sq ft.
      c. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
      a. Test Pressure Differential: 15 psf.
      b. Test Method: AAMA 501.1.
   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: 60, minimum, measured in accordance with AAMA 1503.
   5. Condensation Resistance for proposed assembly: 50, minimum, calculated in accordance with NFRC 500, Simulation Method.
   6. Overall U-value Including Glazing: 0.31 Btu/(hr sq ft deg F), maximum.

2.03 ALUMINUM-FRAMED STOREFRONT - INTERIOR

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1/2 inch laminated glazing.
   2. Glazing Position: Centered (front to back).
   3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   4. Finish: Class I natural anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   5. Finish Color: As selected by Architect from manufacturer's standard line
   6. 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.

7. Construction: Eliminate noises caused by thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

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. Glazing: See Section 08 8000.
C. Exterior Swing Doors: Glazed aluminum Glazed aluminum by storefront manufacturer: D502 Thermastile Series) Basis-of-Design .
   1. Type: heavy duty, .
   2. Thickness: 2 inches.
   3. Top Rail: 5 inches wide.
   4. Vertical Stiles: 5 inches wide.
   5. Bottom Rail: 7-1/2 inches wide.
   6. Glazing Stops: Square.
   7. Glazing: As specified in Section 08 8000.
   8. Overall U-value Including Glazing: 0.56 Btu/(hr sq ft deg F), maximum.
   9. Air Leakage (pair): Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 1.57 psf pressure differential across assembly.
   10. Finish: Same as adjacent storefront.
D. Interior Swing Doors: Glazed aluminum by storefront manufacturer: D518 DuraStile Series (Basis-of-Design)
   1. Type: heavy duty, .
   2. Thickness: 2 inches.
   3. Top Rail: 5 inches wide.
   4. Vertical Stiles: 5 inches wide.
   5. Bottom Rail: 7-1/2 inches wide.
   6. Glazing Stops: Square.
   7. Glazing: As specified in Section 08 8000.
   8. Overall U-value Including Glazing: 0.67 Btu/(hr sq ft deg F), maximum.
   9. Air Leakage (pair): Maximum of 1.0 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 1.57 psf pressure differential across assembly.
   10. Finish: Same as adjacent storefront.

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.
   1. Location: Exterior and Interior Storefronts at Vestibules.
B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
   1. Location: Interior storefronts unless otherwise noted.
C. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent 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.

1. Location: Exterior storefronts and doors.

D. Color: As selected by Architect from manufacturer's standard range.

E. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 HARDWARE

A. For each door, include weatherstripping.

B. Other Door Hardware: See Section 08 7100.

C. Weatherstripping: poly pile, continuous and replaceable; provide on all exterior and vestibule doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings at exterior asemblies. 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. Fill shim spaces at perimeter of assembly with foamed-in-place insulation to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 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.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. 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 directed by Architect.
2. Conduct tests in each area just 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.
    a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
    b. Test shall include perimeter joints and interface with surrounding construction.
    c. Test should be completed prior to application of exterior cladding and interior finishes to properly observe and address points of failure.

C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 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.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following swinging doors:
      a. Aluminum.
      b. Hollow metal.
      c. Flush wood.
   2. **Low-energy ADA automatic door operators requiring electrical work and materials, and installation by AAADM certified installer.**
   3. **Electrified access control door hardware. See Door Hardware Schedule (this Section) for hardware sets prefixed with "E". See electrical specifications for electrical work and materials required.**

1.2 SUBMITTALS

A. Number of Submittals: All items listed in this section are to be included in one submittal prepared by one Supplier.

B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Samples: Provide samples of products intended to be provided as directed by Architect. Samples will be returned to Contractor.

D. Factory-drawn Riser wiring diagrams, detailing conduit types, required backboxes, wire gauges and number of conductors required, door numbers, hardware set numbers, system function descriptions. Include these diagrams with the hardware submittal. Submittals lacking these diagrams will be rejected without review.

E. Qualification Data:
   1. Hardware Supplier
      a. Established contract hardware firm which maintains and operates an office, display, and stock in project area and which is a factory authorized distributor of the lock being furnished.
      b. Hardware scheduled and furnished by or under direct supervision an Architectural Hardware Consultant.
      c. All schedules submitted to the Architect for approval and job use must carry the signature and certified seal of this Architectural Hardware Consultant.
   2. Architectural Hardware Consultant
      a. Currently certified by the Door and Hardware Institute.
      b. Full-time employee of the Hardware Supplier or an individual having no contractual ties to any supplier/manufacturer entity.
      c. Available at reasonable times to Architect, Owner, and Contractor during course of work.
   3. Automatic Door Operator Supplier
      a. Currently certified by AAADM to install both high and low energy automatic door operators.
      b. Include AAADM certificate with hardware submittal for approval.

F. Maintenance Data: For each type of door hardware. Include final hardware schedule, product datasheets, keying schedule, riser diagrams, and point-to-point wiring diagrams in 3-ring binder, labeled on spine with project name and “Door Hardware”.

G. Warranty: Special warranty specified in this Section.

H. Other Action Submittals:
   1. Door Hardware Sets: Prepared by or under the supervision of a DHI certified Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule"; other formats will be rejected without review. Double space entries, and number and date each page.
      b. Numerical Sequence of Sets and Headings: Submittal headings shall be in exact order as hardware sets in specification: one heading only per set. Submittal set numbers shall relate to specification set numbers, ie. if three headings are required for Set 12 due to door width differences, then the heading numbers should be 12.1, 12.2, and 12.3 or employing similar linking logic.
      c. Door Numbers: Identical to those used in the contract documents.
      d. Number of Copies: (5).

e. Content: Include the following information:
   1) Identification number, location, hand, fire rating, and material of each door and frame.
   2) Type, style, function, size, quantity, and finish of each door hardware item.
   3) Complete designations of every item required for each door or opening including name and manufacturer.
   4) Degree of opening for closer and overhead stop and holder installation.
   5) Keying information.
   6) Fastenings and other pertinent information.
   7) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   8) Explanation of abbreviations, symbols, and codes contained in schedule.
   9) Mounting locations for door hardware.
   10) Notes included with specification hardware sets transcribed verbatim into submittal hardware sets.
   11) Door and frame sizes and materials.
   12) List of related door devices specified in other Sections for each door and frame.

f. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in 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 sets.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.3 QUALITY ASSURANCE

A. Furnish proper hardware types and quantities for door function, hardware mounting and clearances, and to meet applicable codes. Bring discrepancies to the attention of the Architect a minimum of (10) days prior to bid date so that an addendum may be issued. No additional compensation will be allowed after bidding for hardware changes required for proper function, hardware mounting or clearances, or to meet codes.

B. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

C. Source Limitations: All items listed in hardware sets are to be furnished by one supplier. Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
   1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
   1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
         2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
      c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
   3. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Thresholds: Not more than 1/2 inch high.
   4. Fire-Rated Door Assemblies: Provide door hardware for 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 NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
      a. Test Pressure: Positive pressure labeling.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Deliver hardware for aluminum doors and stainless steel doors to GC in timely manner so as not to delay fabrication of aluminum and stainless steel doors and frames. Balance of hardware may be delivered to GC at same time, packaged separately from aluminum and stainless steel door hardware, and may be billed as stored materials.

C. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

D. Deliver keys to Owner by registered mail or overnight package service. Obtain Owner's contact name and address from Architect.

1.5 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Distribute templates in a timely manner so as not to delay suppliers. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, and security system.

1.6 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. Retain or edit Warranty period subparagraphs as applicable to Project.

D. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

E. Special Warranty Periods:
1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Ten years for manual door closers.
4. Two years for electromechanical access control door hardware.

1.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components,

lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, material, finish, size and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
   2. References to BHMA Standards: In addition to other requirements in this section, provide products complying with or exceeding these standards and requirements for description, quality, and function.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electrified access control door hardware, in compliance with specifications, must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01 "Substitution Procedures". Approval of requests is at the discretion of the architect, owner, and their designated consultants.

D. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers specified.

2.2 BUTT HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
   2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
   3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
   4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Height, Width, and Weight: Unless otherwise indicated, provide the following:
   1. Doors with Exit Devices or 3'6" or more in width: 5" high, heavy-weight hinges.
   2. Doors less than 3'6" in width: 4-1/2" high, standard-weight hinges.
   3. Width: 4-1/2" heavy-weight, 4" standard-weight, unless proper clearance requires a different width.
   4. Doors with Closers: Antifriction-bearing hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior and in-swinging restroom door hinges: Stainless steel, with stainless-steel pin.
   2. Balance of hinges: Steel, with steel pin.

E. Hinge Options: Provide the following:
   1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for reverse bevel lockable doors.
   2. Corners: Square.
   3. Number of knuckles: Five.

F. Fasteners: Comply with the following:
   1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
   2. Wood Screws: For wood doors and frames.
   3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

4. Screws: Phillips flat-head. Finish screw heads to match surface of hinges.

G. Template Hinge Dimensions: BHMA A156.7.

H. Available Manufacturers:
1. Hager Companies (HAG).
2. McKinney Products Company; an ASSA ABLOY Group company (MCK).
3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
4. PBB, Inc. (PBB)

2.3 ELECTRONIC ACCESSORIES

A. Electronic Power Transfers:

1. Concealed: For new doors and frames, concealed when door is closed. All metal construction, cast housing with steel backboxes, two universal joints and rigid tubing. Acceptable Manufacturers:

a. Security Door Controls (SDC).
b. Securitron Door Controls (SEC).
c. Architectural Builders Hardware (ABH).
d. Hager (HAG).
e. Von Duprin (VON).

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. DPDT contacts.
1. Acceptable Manufacturers:
a. Flair Electronics (FLR).
b. George Risk Industries (GRI).
c. Interlogix (ITL).
d. Architectural Control Systems (ACS).

2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Lock Trim:
1. Levers: Cast.
a. Sargent L model.
2. Roses: Forged.
a. Sargent LN model.
3. Lockset Designs: Provide design indicated in hardware sets, or, if sets are provided by another manufacturer, provide designs that match those designated.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.

E. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Types: Provide mortise or bored locks as indicated by model number in the Hardware Schedule.

B. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
   1. Mortise Locks: BHMA A156.13.

C. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13 Grade 1.
   1. Available Manufacturers:
      a. Best Access Systems; Div. of The Stanley Works (BES).
      b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (COR).
      c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
      d. Schlage Commercial Lock Division; an Allegion Company (SCH).

D. Compatibility with Key Cylinders: fully warranted for use with key cylinder furnished.

2.6 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fasteners. Manufacturer's standard.

F. Shims: Provide shims if needed for clearance.

G. Available Manufacturers:
   1. Detex, Inc. (DTX)
   2. Precision Hardware, Inc. (PH).
   3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
   4. Von Duprin; an Allegion Company (VON).
   5. Corbin-Russwin.

2.7 KEY CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Provide cylinders for all devices requiring key cylinders to properly function: constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Number of Pins: Six or directed by Owner.
   2. Keyway: Patented or non-patented as directed by Owner.
   3. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
   4. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Small-format Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores for locking devices on exterior doors plus (4) extra. Provide 6 construction master keys.

a. Replace construction cores with permanent cores as directed by Owner.

E. Supplemental Items: Provide cylinder spacers, collars, and correct cams as needed for proper function of locking devices.

F. Available Manufacturers:
1. Best Access Systems; Div. of The Stanley Works (BES).
2. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (COR).
3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
4. Schlage Commercial Lock Division; an Allegion Company (SCH).

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
1. Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.

B. Keys: Nickel silver.
1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
a. Notation: "DO NOT DUPLICATE."
2. Quantity: Provide the following:
a. Cylinder Change Keys: Three per cylinder.
b. Master Keys: Six per master.
c. Grand Master Keys: Six.
d. Great-Grand Master Keys: Five.
e. Control Keys: Two.
f. Construction Control Keys: Two.
g. Blanks: Twenty-five.

2.9 OPERATING TRIM

A. Materials: Fabricate from stainless steel, unless otherwise indicated.

B. Dimensions: All dimensions, shapes, fasteners, and other properties identical to models specified in hardware sets.

C. Available Manufacturers:
1. Hager Companies (HAG).
2. IVES Hardware; an Allegion Company (IVE).
3. Rockwood Manufacturing Company (ROC).
4. Trimco (TRI).

2.10 SURFACE CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Comply with the following maximum opening-force requirements:
a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Fasteners: Manufacturer’s standard for arms, shoes and brackets.

D. Mounting Accessories: Provide shoes, brackets, drop plates, spacers, etc., as needed for proper mounting of closers and arms to door and frame.
1. At openings with hollow metal or wood doors in hollow metal frames requiring jamb seals and parallel arm closers, provide 1/4" high or 7/8" high closer arm bracket spacers per the frame stop width for the installation of the critical fifth screw for the arm bracket to the top jamb.

a. Spacers: 1/4" or 7/8" H, 0.625" OD, 0.281" ID countersunk 0.06", deburred outside edges, grooved (0.032"W x 0.032" D) at 1/8" increments for field cutting, solid 6061 aluminum.
b. Basis of Design: Cohni Manufacturing (COH), Elyria, OH (ph: 234-206-1540, www.cohni.com), Screw Spacer Combo Pack (has both 1/4" H and 7/8" H models included), Model S-62-CP-25S.

E. Spring Size of Units: Provide field-sizable closers, adjustable for spring sizes 1-6, plus 50% extra spring power at spring size 6, to meet field conditions and requirements for opening force.

F. Cylinders: 1-1/2" minimum diameter; cast iron or high-silicon alloy aluminum.

G. Mounting Configuration: Unless otherwise indicated by model number in the hardware sets:
1. Do not furnish closers capable of being mounted on the corridor side of doors.
2. If tri-pack closers are furnished for regular arm applications, remove parallel arm shoe from closer box before delivering to job.

H. Available Manufacturers and Series for Rack and Pinion Surface Closers:
1. LCN Closers; an Allegion Company (LCN).
2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).
3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
4. Corbin-Russwin.

2.11 AUTOMATIC DOOR OPERATORS

A. Standard: Set up operator to comply with Low Energy BHMA A156.19 standard. Operator shall also be capable of complying with High Energy BHMA A156.10 standard with no additional equipment required other than safety sensors.

B. Performance Requirements:

1. Not more than 15 lbf (67 N applied)1 inch (25 mm) from latch edge of door to prevent stopped door from opening or closing.
2. If power fails, not more than 30 lbf (133 N applied)1 inch (25 mm) from latch edge of door to manually set door in motion.
3. Warranted for use on out-swinging exterior doors with the use of a supplemental stop.

C. Operation: Power opening and spring closing; power closing to get door latched when encountering resistance. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

D. Operating System: Electromechanical.

E. Microprocessor Control Unit: Solid-state controls.

F. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable latch speed.
5. Adjustable hold-open time of not less than 0 to 30 seconds.
6. Adjustable time delay.
7. Adjustable acceleration.
8. Obstruction recycle.
9. Provide lock interface relay when not specified as part of locking device power supply.
10. On/Off/HO switch on side, top or bottom of housing, as directed by Owner.

G. Mounting: Surface mounted to top jamb.

H. Mounting Accessories: Provide shoes, brackets, drop plates, spacers, etc., as needed for proper mounting of operators and arms to door and frame.

I. Bollards:

1. Of material, size, configuration and shape indicated.

2. Material: Stainless steel.
3. Available Manufacturers for Bollards:

    a. Wikk Industries (WIK).

J. Actuators:

1. Wall Push-Plate Switch: Semiflush, wall-mounted, door control switch; of material, size, and shape indicated; weather resistant for exterior applications; mounted in recessed junction box. Provide engraved message as indicated.
2. Wall Touchless Switch: Semiflush, wall-mounted, door control switch of material, size and shape indicated; mounted in recessed junction box. Provide engraved message as indicated.
3. Material: Stainless steel.
4. Message: International symbol of accessibility and "Push to Open."
5. Available Manufacturers for Actuators:

    a. BEA (BEA).
    b. Wikk Industries (WIK).

K. Automatic Door Operator Signage:

1. Comply with BHMA A156.19.
2. Consult Architect before applying signage to door.

L. Available manufacturers for Automatic Door Operators:

1. Besam SW200i series. (BSM).
2. LCN Closers; an Allegion Company (LCN); Senior Swing series.
3. Stanley Access Technologies (SAT); M-Force series.

2.12 PROTECTIVE TRIM UNITS

A. Size:
    1. Width
        a. Singles, and pairs with removable mullions or surface applied astragals: 2 inches (38 mm) less than door width on push side and 1 inch (13 mm) less than door width on pull side
        b. Other pairs: 1 inch (13 mm) less than door width
    2. Height: as specified in door hardware sets; or, if constrained by door bottom rail height, 1" less bottom rail height.

B. Fasteners: Manufacturer's machine or self-tapping countersunk screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled 4 sides; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel.

D. Available Manufacturers:
    1. Hager Companies (HAG).
    2. IVES Hardware; an Allegion Company (IVE).
    3. Rockwood Manufacturing Company (ROC).
    4. Trimco (TRI).

2.13 MECHANICAL WALL AND FLOOR STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16, Grade 1.
    1. Provide wall stops for doors unless floor, overhead, or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Provide floor stops (and spacers if needed) of proper height and configuration to accommodate floor condition. Where floor or wall stops are not appropriate, provide overhead holders.
    2. Properties. Cast construction with fastener suitable for wall or floor condition.
    3. Available Manufacturers:
        a. Hager Companies (HAG).
        b. IVES Hardware; an Allegion Company (IVE).
        c. Rockwood Manufacturing Company (ROC).
        d. Trimco (TRI).

2.14 OVERHEAD STOPS AND HOLDERS

A. BHMA A156.8, Grade 1. Template for maximum degree of opening before encountering obstruction.

B. Available Manufacturers:
   1. Architectural Builders Hardware Mfg., Inc. (ABH).
   2. Glynn-Johnson; an Allegion Company (GLY).
   3. Hager (HAG).
   4. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
   5. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SAR).

2.15 SILENCERS

A. Provide silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

B. Available Manufacturers:
   1. Glynn-Johnson; an Allegion Company (GLY).
   2. Hager Companies (HAG).
   3. IVES Hardware; an Allegion Company (IVE).
   4. McKinney Products Company; an ASSA ABLOY Group company (MCK).
   5. Rockwood Manufacturing Company (ROC).
   6. Trimco (TRI).

2.16 DOOR GASKETING

A. General: Provide continuous weather-strip gasketing on exterior hollow metal doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners as indicated by models in hardware sets.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. If hardware is to be attached to the frame and would interfere with the gasketing, then provide hardware compatible gasketing that does not need to be cut for the mounting of hardware.
   2. Seals integral to threshold at out-swinging exterior hollow metal doors.

B. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

C. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

D. Jamb Gasketing Materials:
   1. Adhesive Seals. As specified in hardware sets or approved equal.
   2. Screwed-on weatherstrip and sweeps. Neoprene.
   3. Panic type thresholds. Neoprene.

E. Available Manufacturers for Jamb Gaskets (provided they provide items with neoprene inserts):
   1. Hager Companies (HAG).
   2. National Guard Products (NGP).
   3. Pemko Manufacturing Co. (PEM).
   4. Reese Enterprises (REE).
   5. Zero International (ZER).

2.17 THRESHOLDS

A. Standard: BHMA A156.21

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
   1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

D. Fasteners: ¼-20 machine screws and expansion anchors.

E. Gasketing material: At panic-type thresholds: neoprene.

F. Available Manufacturers (provided they provide items with neoprene inserts):
   1. Hager Companies (HAG).
   2. National Guard Products (NGP).
   3. Pemko Manufacturing Co. (PEM).
   4. Reese Enterprises (RE).
   5. Zero International (ZRO).

2.18 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Manufacturer's standard, except as noted in product sections of this specification.

2.19 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, 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. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Pulls: locate pulls as directed by Architect.

B. Mounting Locations:
   1. Floor Stops and Holders: Locate at least 20" out from hinge edge of door for maximum degree of opening before door encounters obstruction.
   2. Wall Stops: Locate so that lockset spindle and wall stop share horizontal and vertical centerlines.
   3. Closers and Overhead Stop/Holders: Template and mount closers and overhead stops for maximum degree of opening before door encounters obstruction or so as to interface with specified wall stops and holders. When used with closers, template and locate overhead stops so that closer arm does not fully extend and bottom out. These functionality requirements override any degree of opening information in the specifications or submittals.

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants." Position for complete seal with bottom of doors with no penetration of air or daylight.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

B. Overhead Stops/Holders: Set adjustable stops for maximum degree of opening before door encounters obstruction. Adjust friction to control door.

C. Door Closers:
   1. Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
   2. Adjust latch period so that door does not slam nor injure fingers.
   3. Adjust spring power so that door properly latches.
   4. Adjust backcheck to slow door down before hitting stop point so as to prevent damage to closer, arm, door, frame, and fasteners.

D. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 DOOR HARDWARE SCHEDULE

HARDWARE SET PREFIX KEY:
E Indicates Electronic Hardware.
No prefix indicates mechanical hardware only.

Hardware Set E01

Non-electrified Items:

All hardware by door supplier.

Electrified Items:

(1)	Door Contact, Surface, TB, DPDT GR2707-AD		628	GRI
(1)	Lot: Control electronics, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Door is monitored for door position.

Hardware Set E02

Non-electrified Items:

(1)	Continuous Hinge	SL24HD	628	SEL
(1)	Semi-Auto Flush Bolt Set, HM	3810 x 3820	626	TRI
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, w/Spring Stop	351-CPS	689	SAR
(2)	Kick Plate	KO050 8 x 1LDW x CS x B4E	630	TRI
(2)	Astragal Seal Set	172NA	628	NGP
(1)	Cat H Jamb Seal Set Note: Apply to side jambs.	135NA	628	NGP
(1)	Cat H Adhesive Jamb Seal Set Note: Apply to top jamb.	2525C	Brown	NGP
(1)	Panic Threshold	896N x RCE	628	NGP

Note 1: 3/8” door undercut required for proper mating of door bottom with seal integral to threshold.

Electrified Items:

(1)	Continuous Hinge	SL24HD x EPT Prep	628	SEL
(1)	Jamb-to-Door Power Transfer	CEPT-10	630	SEC
(1)	Electric Lock	73-8273-LNL	626	SAR
(1)	Door Contact, ¾”, Pop-in, DPDT	195-12	White	GRI
(1)	Lot: (2) card readers, control electronics, call button, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Egress and Ingress by key or card. Doors are monitored for door position.

Hardware Set E03

Non-electrified Items:

(1)	Permanent Key Cylinder Core		626	SAR
(1)	Panic Threshold	896N x RCE	628	NGP

Note 1: 3/8" door undercut required for proper mating of door bottom with seal integral to threshold.

Note 2: Jamb seals and meeting edge seals by aluminum door supplier.

Electrified Items:

(2)	Continuous Hinge	SL11HD x EPT Prep	628	SEL
(2)	Jamb-to-Door Power Transfer	CEPT-10	630	SEC
(1)	NS Panic Device, CVR, 01	43 56 AD8401 x 814	630	SAR
(1)	NS Panic Device, CVR, 03	43 56 AD8404 x 814	630	SAR
(2)	Elect Automatic Door Operator	Senior Swing x 8310-806R	628	LCN
	Note: Provide full width housing. Locate On/Off/HO switch on underside of operator housing.			
(2)	Actuator, Sng-gng	S-SG-3-WR	630	WIK
(1)	Operator Bollard		630	WIK
	Note: Provide 6" x 6" square satin stainless steel in-ground mount bollard post factory with welded sloped top sloped away from the actuator, factory prepped for a single-gang actuator at 36" AFF and a single gang access control prep above it at 44" AFF with a weather shroud above the access control prep. Locate bollard exterior as directed by Architect.			
(2)	Door Contact, ¾", Pop-in, DPDT 195-12		White	GRI
(1)	Lot: Card reader, control electronics, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Free egress. Ingress by key or card. Doors can be placed in the unlocked condition through access control. Doors are monitored for door position.

Hardware Set E03A

Non-electrified Items:

(1)	Permanent Key Cylinder Core		626	SAR

Note 2: Jamb seals and meeting edge seals by aluminum door supplier.

Electrified Items:

(2)	Continuous Hinge	SL11HD x EPT Prep	628	SEL
(2)	Jamb-to-Door Power Transfer	CEPT-10	630	SEC
(1)	NS Panic Device, CVR, 01	43 56 AD8401 x 814	630	SAR
(1)	NS Panic Device, CVR, 03	43 56 AD8404 x 814	630	SAR
(2)	Elect Automatic Door Operator	Senior Swing x 8310-806R	628	LCN
	Note: Provide full width housing. Locate On/Off/HO switch on underside of operator housing.			
(2)	Actuator, Sng-gng	S-SG-3-WR	630	WIK
(1)	Lot: Control electronics, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Free egress. Ingress by key. Doors can be placed in the unlocked condition through access control.

Hardware Set E04

Non-electrified Items:

(1)	Permanent Key Cylinder Core		626	SAR
(1)	Panic Threshold	896N x RCE	628	NGP

Note 1: 3/8" door undercut required for proper mating of door bottom with seal integral to threshold.

Note 2: Jamb seals and meeting edge seals by aluminum door supplier.

Electrified Items:

(1)	Continuous Hinge	SL11HD x EPT Prep	628	SEL
(1)	Jamb-to-Door Power Transfer	CEPT-10	630	SEC
(1)	NS Panic Device, Rim, 03	43 56 AD8504 x 814	630	SAR
(1)	Door Contact, ¾", Pop-in, DPDT	195-12	White	GRI
(1)	Lot: Control electronics, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Free egress. Ingress by key. Door can be placed in the unlocked condition through access control. Door is monitored for door position.

Hardware Set E04A

Non-electrified Items:

(1)	Permanent Key Cylinder Core		626	SAR
(1)	Panic Threshold	896N x RCE	628	NGP

Note 1: 3/8" door undercut required for proper mating of door bottom with seal integral to threshold.

Note 2: Jamb seals and meeting edge seals by aluminum door supplier.

Electrified Items:

(1)	Continuous Hinge	SL11HD x EPT Prep	628	SEL
(1)	Jamb-to-Door Power Transfer	CEPT-10	630	SEC
(1)	NS Panic Device, Rim, 03	43 56 AD8504 x 814	630	SAR
(1)	Door Contact, ¾", Pop-in, DPDT	195-12	White	GRI
(1)	Lot: Card reader, control electronics, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Free egress. Ingress by key or card. Door is monitored for door position.

Hardware Set E05

Non-electrified Items:

(1)	Continuous Hinge	SL24HD	628	SEL
(1)	Manual Flush Bolt	3917-12	626	TRI
(1)	Manual Flush Bolt	3917-24 (top)	626	TRI
(1)	Permanent Key Cylinder Core		626	SAR
(2)	Closer, w/Spring Stop	351-CPS	689	SAR
(2)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Cat H Jamb Seal Set Note: Apply to side jambs.	135NA	628	NGP
(1)	Cat H Adhesive Jamb Seal Set Note: Apply to top jamb.	2525C	Brown	NGP
(1)	Panic Threshold	896N x RCE	628	NGP

Note 1: 3/8" door undercut required for proper mating of door bottom with seal integral to threshold.

Note 2: Overlapping welded steel astragal on push side of inactive leaf by door supplier.

Electrified Items:

(1)	Continuous Hinge	SL24HD x EPT Prep	628	SEL
(1)	Jamb-to-Door Power Transfer	CEPT-10	630	SEC
(1)	Panic Device, Mortise, 04	43 56 8904 x 814	630	SAR
(1)	Lot: Card reader, control electronics, low voltage power, low voltage cabling and terminations, and programming: see Electrical Specifications.			

System Function:

Free egress. Ingress by key or card. Doors are monitored for door position.

Hardware Set 01

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, Regular Arm	351-O	689	SAR
	Note: Provide special templating so as not to conflict with overhead stop.			
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Overhead Stop, HD, Concealed	100S x ADJ	630	GLY

Hardware Set 01A

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, w/Stop	351-PS	689	SAR
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI

Hardware Set 01B

(6)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Manual Flush Bolt	3917-12	626	TRI
(1)	Manual Flush Bolt	3917-24 (top)	626	TRI
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(2)	Closer, w/Stop	351-PS	689	SAR
(2)	Kick Plate	KO050 8 x 1LDW x CS x B4E	630	TRI

Hardware Set 01C

(6)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Manual Flush Bolt	3917-12	626	TRI
(1)	Manual Flush Bolt	3917-24 (top)	626	TRI
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(2)	Closer, HD Parallel Arm	351-P10	689	SAR
(2)	Armor Plate	KA050-2 34 x 1LDW x CS x B4E	630	TRI
(2)	Wall Stop, Convex	1270CX	626	TRI

Hardware Set 01D

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, Regular Arm	351-O	689	SAR
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Extended Wall Stop	1298	626	TRI

Note: Locate on wall approx. 6" down and in from top lock corner of door as far out from hinge as possible.

Hardware Set 01E

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, Regular Arm	351-O	689	SAR
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Convex	1270CX	626	TRI

Hardware Set 01F

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Classroom Lock	73-8237-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, Regular Arm	351-O	689	SAR

Note: Provide special templating so as not to conflict with overhead stop.

(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Overhead Stop, HD, Concealed	100S x ADJ	630	GLY
(1)	Adjustable Jamb Seal Set	107NA	628	NGP
(1)	Surface Sound Sweep	SSDB3	628	DHS

Hardware Set 02

All hardware by door supplier.

Hardware Set 03

(6)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Manual Flush Bolt	3917-12	626	TRI
(1)	Manual Flush Bolt	3917-24 (top)	626	TRI
(1)	Storeroom Lock	73-8204-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(2)	Closer, w/Stop	351-PS	689	SAR
(2)	Kick Plate	KO050 8 x 1LDW x CS x B4E	630	TRI

Hardware Set 03A

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Storeroom Lock	73-8204-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Closer, Regular Arm	351-O	689	SAR
(1)	Kick Plate	KO050 8 x 2LDW x CS x B4E	630	TRI
(1)	Wall Stop, Convex	1270CX	626	TRI

Hardware Set 04

(3)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Entry Lock	73-8205-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(1)	Wall Stop, Convex	1270CX	626	TRI

Hardware Set 04A

(6)	Butt Hinges	TA714 4.5 X 4.0	652	MCK
(1)	Manual Flush Bolt	3917-12	626	TRI
(1)	Manual Flush Bolt	3917-24 (top)	626	TRI
(1)	Entry Lock	73-8205-LNL	626	SAR
(1)	Permanent Key Cylinder Core		626	SAR
(2)	Closer, w/Stop	351-PS	689	SAR
(2)	Kick Plate	KO050 8 x 1LDW x CS x B4E	630	TRI

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.
B. Glazing units.
C. Plastic films.
D. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers.
B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
C. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
D. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2026.
C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2026).
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
E. ASTM C1036 - Standard Specification for Flat Glass; 2025.
F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).
G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
K. GANA (GM) - GANA Glazing Manual; 2022.
L. GANA (LGRM) - Laminated Glazing Reference Manual; 2019.
M. GANA (SM) - GANA Sealant Manual; 2008.
N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).
O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2026.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
D. Manufacturer's qualification statement.
E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

B. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

C. Warranty period begins on date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
1. GGI - General Glass International: www.generalglass.com.
2. JE Berkowitz, LP: www.jeberkowitz.com.
3. McGrory Glass: www.mcgrory.com.
4. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com.

B. Float Glass Manufacturers:
1. AGC Glass North America, Inc: www.agcglass.com.
2. Cardinal Glass Industries: www.cardinalcorp.com.
3. Guardian Glass, LLC: www.guardianglass.com.
4. Pilkington North America Inc: www.pilkington.com/na.
5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.

C. Laminated Glass Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com.
2. Guardian Glass, LLC: www.guardianglass.com.
3. McGrory Glass: www.mcgrory.com.
4. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
3. Glass thicknesses listed are minimum.

B. Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure and air barrier.
1. In conjunction with weather barrier related materials described in other sections, as follows:
   a. Water-Resistive Barriers: See Section 07 2500.
2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.
3. To maintain a continuous vapor retarder and/or air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
3. Impact Resistant Safety Glass: Where required by applicable Code shall Comply with ANSI Z97.1 - Class A, or 16 CFR 1201 - Category II criteria.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class A or 16 CFR 1201 - Category II impact test requirements.
a. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
1. AGC Glass North America, Inc: www.agcglass.com.
2. Cardinal Glass Industries: www.cardinalcorp.com.
3. Guardian Glass, LLC: www.guardianglass.com.
4. Pilkington North America Inc: www.pilkington.com/na.Pilkington North America Inc: www.pilkington.com/na.
5. Viracon, Apogee Enterprises, Inc: www.viracon.com.

B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Warm-Edge Spacers: High Performance Polymer.
a. Spacer Width: As required for specified insulating glass unit.
b. Spacer Height: Manufacturer's standard.
c. Desiccant: Molecular sieve or silica gel, or blend of both.
4. Spacer Color: Black.
5. Edge Seal:
a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
b. Coating: Low-E (passive type), on #2 surface.
1) Basis-of-Design: Guardian Glass, LLC; SunGuard SuperNeutral 54: www.guardianglass.com
4. Warm-edge spacer.
5. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, maximum.
8. Visible Light Transmittance (VLT): 55 percent, minimum.
9. Solar Heat Gain Coefficient (SHGC): .28, nominal.
10. Glazing Method: Dry glazing method, gasket glazing, unless noted otherwise.

2.05 GLAZING UNITS

A. Type G-1 - Monolithic Interior Vision Glazing:
1. Applications: As scheduled.
a. Glazed lites in doors.

b. Partial-height glazed sidelights to doors.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on drawings.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

2.06 PLASTIC FILMS

A. Type F-4 - Decorative Plastic Film: Polyester type.
1. Application: Safety marking on glass panels. Locations as indicated on drawings.
2. Series Type: Frost.
3. Manufacturers:
a. 3M; Fasara Glass Finishes: www.3m.com
b. Avery Dennison; SC900 SuperCast Film Series: www.averydennison.com.
c. Llumar, an Eastman Chemical Company; Decorative Window Film, Llumar: www.llumar.com.

2.07 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
C. Manufacturers:
1. Dow Corning Corporation: www.dowcorning.com/construction.
2. Pecora Corporation: www.pecora.com.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.08 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
B. Spacer Shims: Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
B. Verify that the minimum required face and edge clearances are being provided.
C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
D. Verify that sealing between joints of glass framing members has been completed effectively.
E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 FIELD QUALITY CONTROL

A. Glazing product manufacturers to provide field surveillance of the installation of their products.
B. Monitor and report installation procedures and unacceptable conditions.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
B. Remove nonpermanent labels immediately after glazing installation is complete.
C. Clean glass and adjacent surfaces after sealants are fully cured.
D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION {CH#10006430}

SECTION 09 0561 - 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. Concrete Floor Finishes
   4. Fluid Applied Flooring
   5. Cementitious Cast Underlayment

B. Preparation of existing concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH) during construction.

D. Mitigation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform specified mitigation of concrete floor slabs as indicated by existing conditions. If such mitigation is indicated by results of testing agency's report and is due to a condition not under Contractor's control and could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

E. Mitigation of concrete floor slabs after removal of flooring or adhesives, including abatement of asbestos containing materials, by mechancial or chemical methods of abatement.

F. Cementitious Cast Underlayment Products: Liquid-Applied, Self-Leveling Floor Underlayment; for areas of slab depressions requiring fill.
   1. Note: Gymspum-Based Underlayment products will not be accepted.

G. Preparation Products.
   1. Patching Compounds.
   2. Ramping Compounds.

H. Mitigation Products.
   1. Moisture Mitigation Coatings.
   2. Moisture and Solvent Mitigation Coatings

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements

B. Section 01 8116 - Low-Emitting Materials Restrictions

C. Section 01 8119 - Construction Indoor Air Quality Management

D. Section 01 4000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

E. Section 03 3000 - 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.

F. Section 03 3000 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

G. Section 03 3511 - Concrete Floor Finishes

H. Section 03 3543 - Polished Concrete Finishing

I. Section 09 6500 - Resilient Flooring, Base, and Accessories

J. Section 09 6700 - Fluid-Applied Flooring

K. Section 09 6813 - Tile Carpeting

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

C. ASTM D4259 - Standard Practice for Abrading Concrete; 1988 (Reapproved 2012).

D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
G. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2018.
H. ASTM F3513 - Standard Practice for Single Component, Fluid-Applied Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2024.
I. CHPS (HPPD) - High Performance Products Database; Current Edition.
J. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.
K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Schedule the Pre-Installation Meeting with Contractor, Construction Manager, Architect, and Owner.
B. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.
C. Testing of concrete subfloors to be completed Two Weeks prior to Cementitious Underlayment and Flooring System installation.

1.05 SUBMITTALS

A. **Submittals will not be reviewed until all related flooring system submittals and Flooring Installation System Schedule are received.**
B. See Section 01 3300 - Submittal Procedure.
C. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
D. Visual Observation Report: For existing floor coverings to be removed.
E. 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. (Highlight these items.)
    2. Manufacturer's required bond/compatibility test procedure.
F. Concrete Sub-Floor Product Data: Provide Manufacturer's published data documenting physical characteristics and product limitations of Mitigation, Cast Underlayment, and Preparation Materials. Also Include:
    1. Manufacturer's qualification statement.
    2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over Mitigation, Cast Underlayment, and Preparation materials.
    3. Test reports indicating compliance with specified performance requirements, performed by the General Contractor.
    4. Manufacturer's installation instructions.
G. **Concrete Sub-Floor Testing Report:**
    1. Description of areas tested; including floor plans and photographs illustrating the exact test locations.
    2. Summary of conditions encountered.
    3. Moisture and alkalinity (pH) test reports.
    4. Copies of specified test methods.
    5. Recommendations for mitigation of unsatisfactory surfaces for each condition and proposed finish.
    6. Product data for recommended mitigation coating.
    7. Certificate: Include certification of accuracy by authorized official of testing agency.
    8. Impact of mitigation on project schedule.
    9. Submit report to Architect.
    10. Submit report not more than two business days after conclusion of testing.
H. **Flooring Installation System Schedule**: list the following for each specific combination of substrate, floor covering, and adhesive to be used, in order from substrate to finished floor, including any steps required bewteen products.:
    1. Substrate
    2. Assessment of existing surface condition(s).
        a. Note: Not all surfaces are visible prior to award. Qualified bidders are assumed to have adequate experience to reasonably infer conditions based on building age, substrate, space type/use, and other observable conditions.
    3. Patching Material and Underlayments
    4. Remedial Floor Coating for all flooring system types as required by Drawings as well as should the test results require it.
        a. Preparation, Cast Underlayment, and Floor covering moisture and alkalinity limits and manufacturer's testing requirements for moisture and alkalinity.
    5. Adhesive

6. Floor Covering
7. Seaming material (grout, heat welds, etc)
8. Provide written documentation of manufacturer's warranty and written verification that combination of installation system products are compatible Refer to floor finish specifications for minimum system warranty requirements.

I. Adhesive Bond and Compatibility Test Report.

J. Copy of RFCI (RWP): Maintain on site.

K. Specimen Warranty and Letter: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty. Provide manufacturer's letter indicating floor preparation system is compatible with the flooring product to be installed to ensure maximum warranty.

1. Where System Warranty is specified for installation of Floor Covering, provide products listed by manufacturer of installation system as acceptable for inclusion under that System Warranty.

1.06 QUALITY ASSURANCE

A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

B. Source Limitations: Obtain floor Concrete Floor Slab Preparation for Mitigation, Cast Underlayment, and Preparation products from a single manufacturer.

C. Mitigation 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 five years' experience installing moisture emission coatings.

D. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

E. Mock-Ups: Install mock-ups per sections listed in "Related Requirements" to verify the complete flooring system demonstrate aesthetic effects and set quality standards for materials.

1.07 PRE-INSTALLATION MEETING

A. The following is a list of required attendees:

1. Owner or Owner's Representative
2. Architect.
3. Construction Manager.
4. General Contractor.
5. All subcontractors involved in removals, remediation, preparation, or installation of all flooring in work areas.

B. The following constitutes mandatory discussion items:

1. Finalize construction schedule and ensure availability of materials, installer's personnel, equipment, and facilities needed to avoid delays. Required Concrete Testing shall be a major item of consideration in Schedule, as successful installation of flooring materials depends on proper testing and assessment of test results.
2. Review existing flooring material removal procedures and Owner notifications.
3. Review requirements of 09 0561 - Common Work Results for Flooring Preparation.
4. Review requirements of all flooring material installation as indicated within each flooring material specification sections.
5. Review Flooring Installation System Schedule.
6. Ensure substrate conditions and finishes are in compliance with requirements, including flatness and cleanliness.
7. Start of flooring Work constitutes acceptance of surfaces to be covered and contractors adherence to the criteria in this specification.
8. Finalize "On Site Storage" arrangements for flooring materials.
9. Cover temporary protection requirements for flooring system during and after installation.
10. Review proposed methods and procedures related to flooring installation, including manufacturer's written instructions, and reach aggreement to their conformence. Ensure that 50-70 kilogram roller is used on the project where required by specifications and manufacturer's recommendations.
11. Outline flooring observation and repair procedures after installation.
12. Set procedure for preserving the environmental conditions of the spaces where flooring installations shall take place.
13. Stress intent of mock-up is to verify selections made under sample submittals, demonstrate aesthetic effects, and set quality standards for materials and execution based on concrete slab testing results, use of Manufacturer Certified Installers, addition of underlayments when necessary, and on site supervision with complete understanding of importance of adherence to manufacturer's instructions.
14. Review mock-up requirements, and determine mock-up locations and review schedule.

1.08 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Construct one mock-up, 4 feet long by 4 feet wide, indicating full system installation for all types of floor coverings in project..
C. Locate where directed by Architect.
D. Mock-up may remain as part of work, if in an undisturbed condition at the time of substatial completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
C. Deliver materials in manufacturer's packaging; include installation instructions.
D. Keep materials dry and protect from direct sun exposure, freezing, and ambient temperature greater than105 Degrees F.

1.10 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.
C. Do not install cast underlayment until floor penetrations and peripheral work are complete.
D. During the curing process, ventilate spaces to remove excess moisture.

1.11 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. See Section 01 7836 - Warranties, for additional warranty requirements.
C. Correct defective Work within a five year period after Date of Substantial Completion.
D. Where System Warranty is specified for installation of Floor Covering, products of this section shall be included as part of that System Warranty.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

2.02 MANUFACTURERS

1. ARDEX Engineered Cements; www.ardexamericas.com..
2. CMP Specialty Products; www.cmpsp.com.
3. Custom Building Products; www.custombuildingproducts.com.
4. LATICRETE International, Inc; www.laticrete.com/#sle.
5. MAPEI; www.mapei.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Source Limitations: Furnish all products produced by single manufacturer and obtained from single supplier.
   1. If tile is required, all tile installation products need to be produced by same manufacturer as the mitigation, cast underlayment and floor prep and obtained from single supplier

2.03 APPLICATIONS

A. **Preparation**: Use Self-Leveling Compound or Patching Compound products at all areas receiving new floor finishes. Maximium thickness 1/8 inch, or thickness required to comply with manufacturer's requirements.
B. **Preparation:** Use Ramping Compound products at all areas receiving new floor finishes where there is a change in floor elevation. Maximium thickness 1 inch, or thickness required to comply with manufacturer's requirements and ADA Standards.
C. **Cast-Underlayment:** Use Cast-Underlayment products at all areas requiring infill to slab depressions. Minimum thickness 1 inch. Maximium thickness as required to complete floor finish condititions inidcated in the contract documents.
D. **Mitigation:** Use Mitigation Coating at all areas where the slab moisture content exceeds the allowable range of the manufacturer's requirements.

2.04 MATERIALS

A. **Patching Compound:** Floor covering manufacturer's recommended or approved product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Calcium-aluminate cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted.
3. Gypsum content is prohibited.
4. Compressive Strength: 3,000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
5. Thickness: 1/8 inch, maximum.
6. Products:
    a. ARDEX Engineered Cements ; ARDEX SKM: www.ardexamericas.com/#sle.
    b. CMP Specialty Products; Prepstar: www.cmpsp.com
    c. Custom Building Products; Custom Tech Silk Patching & Finishing Compound: www.custombuildingproducts.com.
    d. LATICRETE International, Inc; NXT Skim: www.laticrete.com/#sle.
    e. MAPEI; Planiprep SC: www.mapei.com.
7. Provide manufacturer's recommended primer when required by substrate surface conditions.

B. **Ramping Compound:** Floor covering manufacturer's recommended or approved product, for use in conjunction with or in lieu of Patching Compound above, in trowelable consistency for filling of small areas or making transitions between flooring materials of varying depths.

1. Gypsum content is prohibited.
2. Compressive Strength: 4,000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.
3. Flexural Strength: 1,000 psi, minimum, after 28 days, when tested in accordance with ASTM C348.
4. Thickness: 1 inch, maximum.
5. Products:
    a. ARDEX Enigeered Solutions; SD-P / SD-P Rapid : www.ardexamericas.com.
    b. CMP Specialty Products; Rampstar: www.cmpsp.com
    c. Custom Building Products; Custom Tech TechPatch RP: www.custombuildingproducts.com.
    d. LATICRETE International, Inc; NXT Patch: www.laticrete.com/#sle.
    e. MAPEI; Topcem Premix: www.mapei.com.
    f. Substitutions: Not permitted.
6. Provide manufacturer's recommended primer when required by substrate surface conditions.

C. **Moisture Mitigation 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 application of preparation and installation products for proposed flooring.

1. Material: Comply with ASTM F3513 .
2. Verify product is tested by its manufacturer to resist the migration of solvents used during removal of flooring or adhesives to degree sufficient to meet flooring installation manufacturer's recommendations, and suitable for adhesion of flooring without further treatment.
3. Thickness: As required for application and in accordance with manufacturer's installation instructions.
4. Products:
    a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
    b. CMP Specialty Products; Lock Down: www.cmpsp.com
    c. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
    d. LATICRETE International, Inc ; LATICRETE NXT Vapor Reduction Coating: www.laticrete.com/#sle.
    e. MAPEI; ; Planiseal VS: www.mapei.com.
    f. Substitutions: Not permitted.
5. Provide manufacturer recommended primer between barrier and levelling products.
6. VOC Content: Materials, except primers, to be certified as Low Emission by one of the following:
    a. Product listing in UL (GGG).
    b. Product listing in CHPS (HPPD).

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.

3.02 PREPARATION

A. General Preparation
   1. Perform following operations in the order indicated:
      a. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
         1) Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
         2) Removal of existing floor covering.
      b. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
         1) Do not attempt to remove coating or penetrating material.
         2) Do not abrade surface.
      c. Preliminary cleaning.
      d. Required Testing:
         1) 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.
         2) Internal Relative Humidity Testings: 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.
         3) Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
      e. Install specified mitigation, if required.
      f. Patching, smoothing, and leveling, as required.
      g. Other preparation specified or required by flooring installtion products or warranties.
      h. Adhesive bond and compatibility test.
      i. Protection of prepared surfaces until time of flooring installation.
   2. Mitigations:
      a. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other mitigation; re-test after correction.
      b. Excessive Moisture Emission or Relative Humidity: Apply moisture mitigation coating over entire suspect floor area.
      c. Excessive Alkalinity (pH): If moisture mitigation coating is required, no additional mitigation 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.

B. Removals
   1. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
   2. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.
   3. 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.

C. Testing
   1. Moisture Vapor Emission
      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 mitigation as indicated. In the absence of manufacturer limits, perform mitigation if test values exceed 3 pounds per 1000 square feet per 24 hours.
      f. Report: Report the information required by the test method.

2. Internal Relative Humidity
    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. Report: Report the information required by the test method.
3. Alkalinity
    a. In the event that test values exceed floor covering manufacturer's limits, perform mitigation as indicated. In the absence of manufacturer limits, perform mitigation if any test value exceeds 75 percent relative humidity.
    b. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
    c. 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.
    d. In the event that test values exceed floor covering manufacturer's limits, perform mitigation as indicated. In the absence of manufacturer limits, perform mitigation if alkalinity (pH) test value is over 10.
4. Adhesive Bond and Compatibility Testing
    a. Comply with requirements and recommendations of floor covering and adhesive manufacturers.

3.03 INSTALLATION

A. **Application of Preparation Products:** Comply with requirements and recommendations found within this specification and of manufacturer.

B. **Application of Mitigation Products:** Comply with requirements and recommendations found within this specication and of treatment manufacturer.

C. Curing:
    1. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
    2. Air cure in accordance with manufacturer's instructions.

3.04 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

B. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

C. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Resilient sound isolation clips.
D. Acoustic Batts.
E. Gypsum sheathing.
F. Gypsum wallboard.
G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 05 1200 - Structural Steel Framing: Structural steel stud framing.
E. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2024.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.
F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.
G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.
N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
Q. ASTM E413 - Classification for Rating Sound Insulation; 2022.
R. CHPS (HPPD) - High Performance Products Database; Current Edition.
S. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
T. UL (FRD) - Fire Resistance Directory; Current Edition.
U. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with acoustic seals.
   1. Provide perimeter and penetration details complying with Acoustic Ratings indicated.
   2. Indicate UL-listed assemblies and components per UL (FRD).

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements, or proof on access to full text of documents via electronic delivery.

PART 2 PRODUCTS

2.01 GYPSUM AND CEMENT BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Deflection: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/360.
      a. Lobbies and Corridors with exterior doors: Intermittent loads of 7.5 lbf/sq ft with maximum mid-span deflection of L/360.
      b. Vestibules: Intermittent loads of 10 lbf/sq ft with maximum mid-span deflection of L/360.
   2. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, unless otherwise indicated.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com.
   2. R-stud, LLC: www.rstud.com.
   3. SCAFCO Corporation: www.scafco.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; 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/360 at 5 psf, or as required for assembly indicated.
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.
   3. Furring: Hat-shaped sections, minimum depth of 7/8 inch, unless otherwise indicated.
   4. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attaches to framing; improves noise isolation performance of wall and floor-ceiling assemblies.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing 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. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

E. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG Corporation: www.usg.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Board and Panel Products shall be manufactured within the Continental United States and Canada, by members of the Gypsum Association group of companies.

C. Provide panels manufactured with 100% Synthetic Gypsum cores.

D. Gypsum Wallboard (GWB): Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch, unless otherwise indicated.
      b. Ceilings: 1/2 inch, unless otherwise indicated.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   5. Mold Resistant Paper Faced Products:
      a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com.
      b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com.
      c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com.

E. Abuse Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Surface Abrasion: Level 2, 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 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
   7. Type: Fire-resistance-rated Type X, UL or WH listed.
   8. Thickness: 5/8 inch.
   9. Edges: Tapered.

F. Impact Resistant Wallboard:
   1. Application: Impact-prone areas indicated on the drawings.
      a. Vocational shops and labs.
   2. Surface Abrasion: Level 3, 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 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
   8. Type: Fire-resistance-rated Type X, UL or WH listed.
   9. Thickness: 5/8 inch.
   10. Edges: Tapered.

G. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas.
      a. Installer Option: Where tile does not extend the full height of a wall, backing board may extend beyond tile to full height of wall in lieu of regular GWB.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Regular and Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.
6. Regular Board Thickness: 5/8 inch.
7. Edges: Tapered.
8. Products:
    a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com.
    b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com.
    c. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

H. 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.
    a. Option: 5/8 inch Gypsum Wall Board may be used in lieu of Ceiling Board, with proper adjustments to framing.
3. Edges: Tapered.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Batts: Mineral Fiber, Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Tape Thickness: 1/4 inch.
3. Products:
    a. Armacell LLC; ArmaComfort MTD: www.armacell.us.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:
    a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com.
    b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com.

D. Acoustic Gaskets: Pliable one-part intumescent firestop material designed for wall openings.
1. 3M Fire Barrier Moldable Putty Pads: www.3m.com

E. 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. Expansion Joints:
    a. Type: V-shaped metal with factory-installed protective tape.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

G. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
1. Products:
    a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com.
    b. USG Corporation; USG Sheetrock Brand Tuff-Hide Primer-Surfacer: www.usg.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

H. Extruded Moldings: Extruded 6063 aluminum in accordance with ASTM B221, with perforated tape flanges for GWB application.
1. Trim: L-Style for application at edge of GWB. (Gordon 200 Series)
2. Corner: Structural Corner for application at 90 degree outside corners in high abuse areas. (Gordon 901 Series)
3. Corner: Outside Corner for application to non-90 degree outside corners. (Gordon 980 Series)
4. Reveal: Z-Style for application at edge GWB to create shadow line at interface with other meterials. (Gordon 300 Series)
5. Reveal: F-Style for application at edge GWB to create shadow line at interface with other meterials. (Gordon 400 Series)
6. Reveal: U-Style for application at in field of GWB to create shadow line. (Gordon 500 Series)
7. Transition: Z-Style for application at change of thickness in GWB. (Gordon 903 Series)
8. End Cap: For use in cased openings, wall terminations, and capping of kneewalls where indicated. (Gordon 911 Series)

9. Provide matching inserts, alignment devices, and end closures.
10. Finish: Clear anodized, where exposed surface of trim is not intended to be painted.
11. Finish: factory primed for field painting.
12. Products:
    a. Gordon Interior Specialties; Final Forms: www.gordon-inc.com. (Basis-of-Design)
    b. Fry Reglet Architectural Metals; Drywall Reveals; www.fryreglet.com.
    c. Pittcon Industries; Softforms; www.pittconindustries.com.
    d. Tamlyn; XtremeInterior Corner Trim: www.xtremeias.com.
    e. Other manufacturers demonstrating compliance with Specifications and Basis-of-Design Product.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

J. 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.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure in all locations unless otherwise indicated.
   2. 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.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

D. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
   1. Orientation: Horizontal.
   2. Spacing: As indicated.

E. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.

F. Spring Ceiling Hanger System for Acoustic Ceiling Assembly:
   1. Kinetics Noise Controls: Model KSCH; www.kineticsnoise.com
   2. Mason Industries: 30CSCH, W30SM, 30SMCC; www.mason-ind.com

G. Blocking: Install wood blocking for support of wall and ceiling mounted items including but not limited to:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Wall-mounted door hardware.
   5. Wall mounted equipment installed by contractor or to be installed by owner (coordinate locations)

3.03 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. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

D. Acoustic Gaskets: Apply to back of junction boxes and similar penetrations in partitions to reduce sound transfer through assemblies.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.05 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.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish (MPI G5 or greater) and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. 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.

C. 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.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for wall applications.
B. Thresholds.
C. Ceramic trim.
D. Non-ceramic trim.
E. Setting Materials, Grouts, Maintenance Materials & Accessory Materials

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.
C. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
D. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
E. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
F. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).
G. 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; 2017.
H. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2017.
I. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).
J. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).
K. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.
L. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.
M. EJ171 - Movement Joint Guidelines for Ceramic, Glass, and Stone; Current Edition.
N. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
D. Tiling Schedule: on installer's letterhead for each system included in project, including:
    1. Substrate requirements. materials, including required water or vapor proofing properties.
    2. Installation Method per TCNA (HB).
    3. List of proposed materials in order from substrate to finished surface, including surface preparation, water or vapor proofing products, membranes, setting materials, tiles, trims, thresholds, grouts, and sealers.
        a. Tag specific tile products with Architect's tile and color designations.

E. Shop Drawings: Indicate tile layout, patterns, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, setting details, and non-ceramic trim.

F. Selection Samples: For each finish where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of finishes, colors and textures.
   1. Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
   2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.

G. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Stone thresholds in 6-inch lengths (colors and profiles).
   3. Metal edge strips in 6-inch lengths (colors and profiles).

H. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
   2. Submit documentation of completion of apprenticeship and certification programs.

I. Manufacturer Qualifications Statement.

J. Installer Qualifications Statement.

K. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 5 percent of each size, color, and surface finish combination.
      a. Extra materials that match and are from same production runs as products installed and are packaged with protective covering for storage and identified with labels describing contents.
   3. Grout: Furnish quantity of grout equal to 5 percent of amount installed for each type, composition, and color indicated.

1.06 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Source Limitations:
   1. For Tile: Obtain tile of each type and color or finish from one source or producer.
      a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
   2. For Setting, Grouting and Accessory Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
   3. For Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
      a. Stone thresholds.
      b. Joint sealants.
      c. Cementitious backer units.
      d. Metal edge strips.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum ten years of documented experience.

D. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.
      a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).
   2. Installer Certification:
      a. Advanced Certifications for Tile Installers (ACT): Certification in the installation of membranes, mortar bed (mud) floors, shower receptors, large format tile, gauged porcelain tile/panels/slabs, and grouts.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
   1. Minimum size of mock-up: as indicated on drawings or as required to demonstrate pattern repeat in two directions.

2. Approved mock-up may remain as part of the Work, if undisturbed at the time of substantial completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.09 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.

C. Do not install tile until construction in spaces is complete and ambient temperature and humidty conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Special Project Warranty: Submit tile Installer's warranty, signed by Installer, covering Work of this and associated Sections, including including surface preparation, water or vapor proofing products, membranes, setting materials, tiles, trims, thresholds, grouts, and sealers for the following warranty period:

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

2.02 TILE

A. Manufacturers:

1. American Olean Corporation: www.americanolean.com/#sle.
2. Crossville, Inc: www.crossvilleinc.com
3. Dal-Tile Corporation: www.daltile.com/#sle. (Basis of Design)
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Glazed Wall Tile, Type CT-1: ANSI A137.1 standard grade.

1. Products:
   a. Daltile: Relicca (Basis-of-Design)
   b. Substitutions: See Section 01 6000 - Product Requirements.
2. Thickness: 5/16 inch.
3. Shape: Square.
4. Edges: Lugged.
5. Surface Finish: High gloss.
6. Color(s): As indicated on drawings.
7. Grout Width: 1/16 inch.
8. Grout Color: To be selected from manufacturer's full range.
9. Metal Trim: Provide metal trim as follows, unless indicated otherwise.
   a. Exposed ends: Schluter; JOLLY.
   b. Exposed top edge: Schluter; JOLLY.

C. Glazed Wall Tile, Type CT-2: ANSI A137.1 standard grade.

1. Products:
   a. Daltile: Color Wheel Classic (Basis-of-Design)
   b. Substitutions: See Section 01 6000 - Product Requirements.
2. Thickness: 5/16 inch.

3. Shape: Square.
4. Edges: Cushioned.
5. Surface Finish: High gloss.
6. Color(s): As indicated on drawings.
7. Grout Width: 1/16 inch.
8. Grout Color: To be selected from manufacturer's full range.
9. Metal Trim: Provide metal trim as follows, unless indicated otherwise.
    a. Exposed ends: Schluter; JOLLY.
    b. Exposed top edge: Schluter; JOLLY.

D. Glazed Wall Tile, Type CT-3: ANSI A137.1 standard grade.
1. Products:
    a. Daltile: Color Wheel Classic - to match existing
    b. Substitutions: See Section 01 6000 - Product Requirements.
2. Thickness: 5/16 inch.
3. Shape: Square.
4. Edges: Cushioned.
5. Surface Finish: High gloss.
6. Color(s): To be selected by Architect from manufacturer's full range.
7. Grout Width: 1/16 inch.
8. Grout Color: To be selected from manufacturer's full range.
9. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

E. Metal Wall Tile, Type MT-1: ANSI A137.1 standard grade.
1. Products:
    a. Daltile: Metallica (Basis-of-Design)
    b. Substitutions: See Section 01 6000 - Product Requirements.
2. Thickness: 3/8 inch.
3. Shape: Square.
4. Edges: Square.
5. Surface Finish: Metallic/patina.
6. Color(s): As indicated on drawings.
7. Grout Width: 1/8 inch.
8. Grout Color: To be selected from manufacturer's full range.
9. Metal Trim: Provide metal trim as follows, unless indicated otherwise.
    a. Exposed ends: Schluter; JOLLY.
    b. Exposed top edge: Schluter; JOLLY.

2.03 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
1. Applications: for use with CT-3, to match existing profiles.
2. Manufacturers: Same as for tile.

B. Metal Trim: Extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
    a. As indicated by Tile Types above.
    b. As detailed on drawings.
2. Manufacturers:
    a. Schluter-Systems: www.schluter.com/#sle.
    b. Profilitec: www.profilitec.com/en.html
    c. Progress Profiles America, Inc: www.progressprofiles.com
    d. Substitutions: See Section 01 6000 - Product Requirements.
3. Finish: Satin copper anodized aluminum.
4. Accessories: Provide manufacturer's standard splice plates, inside and outside corners and transitions, and termination caps to match profile and finish of trim.

C. Thresholds: Quartz complying with ASTM C616/C616M, honed finish; 4 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled long edge(s) at 1:2 slope with lower edge no more than 1/16inch above adjacent floor finish. Ease all exposed edges and corners. Comply with ADA Standards.
   1. Applications:
      a. At toilet room doors, acting as a reducer from existing tile flooring to exposed concrete finish.
   2. Color: SSM- ____

2.04 SETTING MATERIALS

A. Improved Latex-Portland Cement Mortar Bond Coat meeting all requirements of: ANSI A118.15.
   1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
      b. Custom Building Products; ProLite Premium Large Format Tile Mortar: www.custombuildingproducts.com/#sle.
      c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com/#sle.
      d. MAPEI Corporation; Kerabond/Keralastic: www.mapei.com

2.05 GROUTS

A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: For installation at all wet locations including but not limited to toilet rooms and backsplash tile where sinks are installed.
      a. Provide Industrial Grade, 100 percent solids, epoxy grout exceeding the perfomance standards of ANSI A118.3 and ANSI A118.5, and capable of withstanding prolonged exposure to temperatures up to 185 degrees F, and intermittent exposure to temperatures up to 350 degrees F.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Products:
      a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com/#sle.
      b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      c. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
      d. MAPEI Corporation; Kerapoxy: www.mapei.com

2.06 MAINTENANCE MATERIALS

A. Tile Sealant: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section Joint Sealants.
   1. Applications: Movement joints and between tile and plumbing fixtures.
   2. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, subpart D (EPA Method 24)
   3. Color(s): As selected by Architect from manufacturer's full line.
      a. Use installation system manufacturer's selants color-matched to grout, unless otherwise indicated.
   4. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S, Grade NS, Class 25; Uses NT, G, A, and, as applicable to non-porous joint substrates indicate, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other non-porous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

B. Grout Release: Temporary, water-soluble pre-grout coating.

2.07 ACCESSORY MATERIALS

A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.08 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer's written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. 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.

B. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

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. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated and per TCNA (HB) - EJ171. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
    1. Prepare joints and apply sealants to comply with requirements in Division 07 Section JOINT SEALANTS.
D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
E. 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.
    1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
F. Form internal angles square and external angles with trim indicated.
G. Install non-ceramic trim in accordance with manufacturer's instructions.
H. Install thresholds where indicated in same type of setting bed as adjacent floor unless otherwise indicated.
    1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-Portland cement mortar (thin set).
I. Sound tile after setting. Replace hollow sounding units.
J. Keep control and expansion joints free of mortar, grout, and adhesive.
K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
L. Grout tile joints unless otherwise indicated.
M. 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. Lay out movement joints per TCNA (HB) - EJ171, approved shop drawings, and areas indicated below. Do not grout these joints - provide appropriate elastomeric sealant or specified control joint accessory.
    1. Perimeter expansion, where Floor Tile meets Wall Tile; not less than ¼ inch and commonly covered by tile trim, cove base, or shoe molding
    2. Walls at inside corners.
    3. Walls where Wall Tile meets door and window frames.
    4. Interior: Maximum of 25ft in each horizontal and vertical direction
    5. Interior tilework exposed to direct sunlight (heat) or moisture: maximum of 12 ft in each direction.
    6. Where tile meets door frames
    7. Where tile meets the floor
    8. Where tile abuts another material and no trim is present
    9. Tile to Tile inside corners.

3.04 INSTALLATION - WALL TILE

A. Method: TCNA (HB) - W202I.
    1. Tile Type: CT- and MT-.
    2. Substrate: water-resistant gypsum board.
    3. Setting: Improved Latex-Portland Cement Bond Coat.
    4. Grout: Water-cleanable epoxy.

3.05 CLEANING

A. Clean tile and grout surfaces.

B. Remove epoxy and latex-Portland cement grout residue from tile as soon as possible.

C. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

D. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

3.06 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Do not permit traffic over finished floor surface for seven (7) days after installation.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. (SUSP) Suspended metal grid ceiling system.
B. (APC) Acoustical panels (units)
C. Products furnished, but not installed under this Section include anchors, clips, and other ceiling attachment devices.

1.02 RELATED REQUIREMENTS

A. Section 01 2200 - Unit Prices
B. Section 01 8113 - Sustainable Design Requirements
C. Section 01 8116 - Low-Emitting Materials Restrictions
D. Section 01 8119 - Construction Indoor Air Quality Management
E. Section 09 2116 - Gypsum Board Assemblies: Acoustical Drywall Ceiling and Wall Systems
F. Section 09 9123 - Interior Painting

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
E. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).
F. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
G. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).
H. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
J. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation; 2017.
K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
M. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.
N. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
O. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.
P. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.
Q. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
R. CHPS (HPPD) - High Performance Products Database; Current Edition.
S. Hardwood Plywood & Venner Association (HPVA)
T. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Do not install acoustical units until after interior wet work is dry.

1.05 PRICE AND PAYMENT PROCEDURES

A. Alternates: See Section 01 2300-Alternates

B. Unit Prices: See Section 01 2200-Unit Prices.

1.06 SUBMITTALS

A. See Section 01 3300 - Submittal Proceedures.

B. See Section 01 8113 - Sustainable Design Requirements for LEED submital procedures.

C. Shop Drawings: Indicate grid layout and related dimensioning, and details of substrate joints, components and attachments to other work.

D. Product Data: Provide data on suspension system components, acoustical units, and each type of product indicated.

E. Samples: Submit one sample 6 by 6 inch in size illustrating material and finish of acoustical units.

F. Samples: Submit one sample each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

G. System Description Letter: on installer's letterhead for each system included in project, including:

1. Substrate requirements.
2. List of proposed materials in order from substrate to finished surface, including acoustic panels, suspension systems and accessories
   a. Indicate materials included in manufacturer's Installation System Warranty.
3. Manufacturer's Warranty.

H. Closeout Submittals: Maintenance Data for finishes to include in maintenance manuals

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.
3. Suspension-System Components: Quantity equal to 5 percent of total installed.
4. Hold -Down Clips: Quantity equal to 5 percent of total installed.
5. Impact Clips: Quantity equal to 5 percent of total installed.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to VNLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling and interior system in area as shown on Drawings or directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at the time of Substantial Completion.

C. Source Limitations: Obtain acoustical system from single source from single manufacturer.

D. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of systems required for this project.

E. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

F. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

G. Coordination of the Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers (if applicable).

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels (units), metal, and wood systems, suspension-system components, and accessories to Project site in original, unopened packages 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 panels (units), metal, and wood systems, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels (units), metal, and wood systems carefully to avoid chipping edges or damaging units in any way.

1.09 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after installation of all products covered in this section.
   1. Do not install products covered in this section until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceiling is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   2. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Installation System Warranty: From date of substantial completion, provide manufacturer's standard system warranty, executed per the manufacturer's requirements, agreeing to repair or replace defective materials, including labor and materials, and as follows:
   1. Mineral Fiber and Glass Fiber Systems:
      a. Warranty Term: 30-Year Limited Warranty
   2. Warranty shall include repair or replacement of acoustic panels and suspension systems directly affected by failure of covered materials.
   3. Limit of Liability: No Dollar Limitation. (NDL)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustical Tiles/Panels (APC):
   1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. USG: www.usg.com.

B. Suspension Systems (SUSP):
   1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. USG Corporation; ____: www.usg.com/ceilings/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Noise reductions Coefficient (Acoustical Plaster): NRC 0.85; ASTM c423 - 07a Test Mounting Type A

2.03 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   2. Smoke Developed Index: 450 or less.
   3. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).
      b. Product listing in CHPS (HPPD).
   4. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
   5. Acoustical Panel Standard: Provided Manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.
   6. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4" inches away from test surface according to ASTM E795.
   7. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   8. Provide humidity and sag resistant systems such as:
      a. "HumiGuard" by Armstrong
      b. "ClimaPlus" by USG
      c. 140/90-95 by Certainteed

9. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard 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 and evaluated according to ASTM D3274 or ASTM G21.

B. Acoustical Panels, Type APC-1: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Application(s): Classrooms, Offices, Small Group Rooms. For use with Ceiling System Type A1.
   2. Classification: ASTM E1264 Type IV.
      a. Form: 2, water felted.
      b. Pattern: "E" - lightly textured.
   3. Size: 24 by 24 inches.
   4. Thickness: 3/4 inch.
   5. Light Reflectance: .88 percent, determined in accordance with ASTM E1264.
   6. NRC Range: .75 to .90, determined in accordance with ASTM E1264.
   7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   8. Panel Edge: Reveal.
   9. Color: White.
   10. Suspension System Type SUSP-B: Exposed grid.
   11. Products:
      a. Armstrong World Industries, Inc; Ultima: www.armstrongceilings.com/#sle.
      b. USG Corporation; Mars Acoustical Panels: www.usg.com/ceilings/#sle.
      c. CertainTeed; Symphony m HRC: www.certainteed.com

C. Acoustical Panels, Type APC-2: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Application(s): Areas of High Humidity and Toilet Rooms. For use with Ceiling System Type H1.
   2. Classification: ASTM E1264 Type IV.
      a. Form: 2, water felted.
      b. Pattern: "E" - lightly textured.
   3. Size: 24 by 24 inches.
   4. Thickness: 3/4 inch.
   5. Light Reflectance: .86 percent, determined in accordance with ASTM E1264.
   6. NRC Range: .70 to .90, determined in accordance with ASTM E1264.
   7. Ceiling Attenuation Class (CAC): 38, determined in accordance with ASTM E1264.
   8. Panel Edge: Reveal.
   9. Color: White.
   10. Suspension System: Existing grid system.
   11. Products:
      a. Armstrong World Industries, Inc; Ultima Healthcare; Product No. 1937: www.armstrongceilings.com/#sle.
      b. USG Corporation; Mars Healthcare Clean Room Acoustical Panels; Product No. 86684: www.usg.com/ceilings/#sle.
      c. CertainTeed; Symphony Rx M HRC; Product No. 1222B-RXS-1: www.certainteed.com

D. Acoustical Panels APC-3: Mineral fiber with membrane-faced overlay, with the following characteristics:
   1. Classification: ASTM E1264Type IV.
      a. Pattern: "E" - lightly textured.
   2. Size: 24 by 48 inches.
   3. Thickness: 3/4 inch
   4. NRC Range: 0.70 to 0.75 to ____, determined in accordance with ASTM E1264.
   5. Panel Edge: Square.
   6. Color: White.
   7. Suspension System: Direct attach to hat channel furring with self stopping fasteners.
   8. Mounting:
      a. Direct-Attach to hat channel furring with self stopping fasteners.
      b. For Unit Price only: Direct-apply adhesive: Titebond Greenchoice Acoustical ceiling tile adhesive, as recommended by Manufacturer's written instructions.
   9. Products:
      a. USG Corporation; Umbral Direct Mount.

b. Armstrong World Industries, Inc.; InvisAcoustics Armstrong World Industries, Inc.; InvisAcoustics.

2.04 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
      b. Aluminum Grid: Aluminum sheet, ASTM B209/B209M.

B. Exposed Suspension System, Type SUSP-B: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 9/16 inch face width.
   3. Finish: Baked enamel.
   4. Color: White.
   5. Products:
      a. Armstrong World Industries, Inc; Superfine 9/16": www.armstrongceilings.com/#sle.
      b. USG Corporation; USG Centricitee DXT: www.usg.com/#sle.
      c. CertainTeed; 9/16" EZ Stab Elite Narrow System: www.certainteed.com

2.05 TRIM AND ACCESSORIES

A. Subject to compliance with requirements, provide products listed below by one of the following:
   1. Armstrong World Industries, Inc: www. armstrong.com.
   2. USG Corporation: www.usg.com/ceilings
   3. CertainTeed Corp.: www.certainteed.com

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

D. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

E. Hold-Down Clips: Manufacturer's standard clips to suit application.

F. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

G. Perimeter Moldings: Same metal and finish as grid.
   1. Size: As required for installation conditions.
   2. Shadow Molding: Shaped to create a perimeter reveal.
   3. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
      a. Acoustical Sealant for Exposed and Concealed Joints:
         1) Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant
         2) USG Corporation; SHEETROCK Acoustical Sealant
      b. Acoustical Sealant for Concealed Joints:
         1) Henkel Corporation; OSI Pro-Series SC175 Acoustical Sound Sealant
         2) Pecora Corporation; AIS-919
         3) Tremco, Inc.; Tremco Acoustical Sealant.

H. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction and as demonstrated by testing representative assemblies according to ASTM E90.
   1. Exposed and concealed joints: Non-sag, paintable, non-staining latex sealant
   2. Concealed Joints: Non-drying, non-hardening, non-skinning, Nonstaining, gunnable, synthetic rubber sealant
   3. acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Verify existing conditions before starting work.

C. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

D. Verify that layout of hangers will not interfere with other work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Install in bed of acoustical sealant.
2. Use longest practical lengths.
3. Overlap and rivet corners.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions. And as indicated on reflected ceiling plans

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.05 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.

1. Extend of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion by no panels have been installed.
    a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbg of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them from 440 lbf of tension.
    b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspections reports.

3.06 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touch up of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING, BASE, AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.
B. Rubber tile flooring for elevator.
C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
E. Section 14 2100 - Electronic Traction Passenger Elevators.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
B. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2017a.
C. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.
D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).
E. CHPS (HPPD) - High Performance Products Database; Current Edition.
F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.
G. NFPA 258 - Recommended Practice for Determining Smoke Generation of Solid Materials; 2001.
H. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers. See Section 09 0561 Common Work Results for Flooring Preparation for meeting requirements.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
   2. Review requirements in Section 09 0561 Common Work Results for Flooring Preparation.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Submittals will not be reviewed untill all related flooring system submittals are received.
D. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
E. Shop Drawings: Indicate substrate build up for resilient base, and coordination with SSM-2 wall paneling.
F. Selection Samples: For each type where color selection is not indicated or proposed material varies from Basis-of-Design, provide two sets of color chips representing proposed manufacturer's full range of available colors, patterns, and textures.
   1. Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
   2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.
G. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring and base product specified.
H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Wall Base and Accessories: Not Less than 10 linear feet, or fraction thereof, of each type and color.

1.06 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 65 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.08 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 65 degrees F.

1.09 WARRANTY

A. Manufacturer's Warranty: From date of substantial completion, provide manufacturer's standard form in which the resilient flooring and accessories will protected against defects in material and workmanship and conform to product specifications, provided installation, maintenance and use falls within the manufacturer's current written instructions.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Rubber Tile - Type RT-1: Homogeneous Rubber Tile, Type IB and Grade 1. For use in Elevator. See specification 14 2100.

1. Basis of Design: Nora, Norament Satura XP.
2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
3. Smoke Density: Maximum 450, when tested in accordance with ASTM E662 or NFPA 258.
4. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
5. VOC Content Limits: As specified in Section 01 6116.
6. VOC Content: Certified as Low Emission by one of the following:
   a. Product listing in UL (GGG).
   b. Product listing in CHPS (HPPD).
7. Size: 39.5 by 39.5 inch nominal.
8. Total Thickness: 0.125 inch.
9. Texture: Hammered.
10. Color: As indicated on drawings.

2.02 RESILIENT BASE

A. Resilient Base (RB): ASTM F1861, Type TS rubber, vulcanized thermoset.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Baseworks: www.johnsonite.com/#sle.
   b. Roppe Corporation; Pinnacle: www.roppe.com/#sle.
   c. Nora Systems, Inc..
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. Smoke Density: Maximum 450, when tested in accordance with ASTM E662 or NFPA 258.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Style and Locations:
   a. Style A, Straight: Provide in areas with carpet
   b. Style B, Cove: Provide in areas with resilient flooring and exposed concrete flooring.
5. Height: 4 inch.
6. Thickness: 0.125 inch.
7. Finish: Satin.
8. Length: Roll.
9. Color: As indicated on drawings.

10. Outside Corners: Job formed.
11. Inside Corners: Job formed.

2.03 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

B. Substrate preparation: cementitious patching compound at masonry to receive resilient base.
   1. See 09 0561 Common Work Results for Flooring Preparation for cementitious patching product.

C. Adhesive: Subject to compliance with manufacturer's recommendations, provide the following :

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 concrete sub-floor surfaces are ready for installation in accordance with section 09 0561 - Common Work Results for Flooring Preparation.

C. Verify that wall surfaces are clean, smooth, permamnently dry, structurally sound, and flat within the tolerances specified for that type of work, and are ready to receive resilient base.

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 09 0561 and manufacturer's recommendations.

B. Prepare masonry wall substrates for installation of resilient base and adhesive in accordance with manufacture's recommendations.
   1. Provide cementitious patching/leveling compound as required to fill mortar joints, irregularities, and surface texture and provide a smooth, continuous substrate suitable for adhered resilient base.

C. Prepare wall substrates per manufacturer's recommendations, correcting deficencies encountered.
   1. Fill cracks, voids, divots, grout lines and imperfections with a patch or filler suitable for the substrate, allowing for curing time prior to installing base.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor and substrate 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.

3.04 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.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

C. Job-Formed Corners: Install corners before installing straight pieces
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.
      a. Fold base at corner point and scribe backside. Apply heat and crease corner.
      b. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.
      a. Fold base at corner point and scribe backside. Apply heat and crease corner.
      b. Cut triangular wedge from toed base.
      c. Form without producing discoloration (whitening) at bends

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions no sooner than 72 hours after installation.

C. Provide manufacturer's recommended initial maitenance procedure.

1. Verify proposed product(s) with Owner prior to application.

3.07 PROTECTION

A. Prevent all traffic for a minimum of 12-hours and rolling loads for 72-hours to allow the adhesive to cure.

B. Protect flooring from damage during construction operations and placement of equipment and fixtures using Masonite, plywood or a similar product, ensuring first that the flooring surface is free of all debris. Lay panels so that the edges form a butt joint and tape the joint to prevent both movement and debris entrapment underneath. Inspect immediately before covering and after removal.

C. Protect flooring from mars, marks, indentations, and other damage until final acceptance and turnover to Owner.

END OF SECTION

SECTION 09 6700 - FLUID-APPLIED FLOORING

ADD ALTERNATE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Trowel-applied flooring.

1.02 RELATED REQUIREMENTS

A. Section 01 2200 - Unit Prices
B. Section 01 2300 - Alternates
C. Section 01 8113 - Sustainable Design Requirements
D. Section 01 8116 - Low-Emitting Materials Restrictions
E. Section 01 8119 - Construction Indoor Air Quality Management
F. Section 07 9200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.
G. Section 09 0561 - Common Work Results for Flooring Preparation: Cleaning and preparation.
H. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. EN196-1, ASTM C349 - Standard Test Method for Compressive Strength
B. EN196-1, ASTM C348 - Standard Test Method for Flexural Strength
C. EN 1062-3:2008 - Standard Test Method for Water Permeability
D. EN 1542:1999 - Standard Test Method for Tensile Adhesion Strength
E. ASTM C1028 - Standard Test Method for Slip Resistance (SCOF)
F. BS 7976 - Standard Test Method for Slip Resistance (TRL Pendulum Test)
G. EN ISO 5470-1 - Standard Test Method for Abrasion Resistance (Taber)
H. EN 13529 - Standard Test Method for Chemical Resistance

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers. See Section 09 0561 Common Work Results for Flooring Preparation for meeting requirements.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
   2. Review requirements in Section 09 0561 Common Work Results for Flooring Preparation.

1.05 PRICE AND PAYMENT PROCEDURES

A. Alternates: See Section 01 2300-Alternates.
B. Unit Prices: See Section 01 2200-Unit Prices.

1.06 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures.
C. Submittals will not be reviewed untill all related flooring system submittals are received.
   1. Substrate Test Results per 09 0561 Common Work Results for Flooring Preparation.
   2. Flooring System Schedule per 09 0561 Common Work Results for Flooring Preparation.
D. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
E. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.
F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
G. Manufacturer's Qualification Statement.
H. Applicator's Qualification Statement.

I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Top Coat Materials: 2 gallons.

1.07 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section.

1. Applicator shall have completed minimum 10 projects of similar size and complexity using products of similar type and installation method.
2. Applicator shall have completed minimum3 projects of similar size and complexity using approved product and installation method.
3. Applicator shall have completed training and certification by approved product's manufacturer.

1.08 MOCK-UP

A. See Section 01 4500 - Quality Control for additional requirements.

B. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.

1. Number of Mock-Ups to be Prepared: One.
2. Use same materials and methods for use in the work.
3. Locate where directed.
4. Minimum Size: 48 inches by 48 inches.

C. Obtain approval of mock-up by Architect before proceeding with work.

D. Approved mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.10 FIELD CONDITIONS

A. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 TROWEL-APPLIED FLOORING SYSTEMS

A. Performance Requirements:

1. Compressive Strength: 13,635 psi (94 N/sq. mm), ASTM C349.
2. Flexural Strength: 4,350 psi (30 N/sq. mm), ASTM C348.
3. Tensile Adhesion Strength: Greater than 2.0 MPa to concrete, tested in accordance with EN 1542.
4. Water Permeability: Less than 0.001 kg/(sq. m x h^0.5), DIN/EN 1062-3.
5. Abrasion Resistance: Average mass loss of 535 mg, EN ISO 5470-1.
6. Chemical Resistance: Resistant to chemicals anticipated for Project conditions and cleaning agents used in service.
7. Temperature Resistance: Suitable for sustained temperatures up to 149 deg F (65 deg C).

B. Trowel-Applied Flooring: Resinous system with acrylic coating, quartz filled.

1. System Thickness: 4mm.
2. Finish: Satin
3. Color: As selected by Architect.
4. Basis of Design Product: Acrylicon USA; Acrylicon Decor System.
   a. Resinous system, transparent, solvent free, medium viscosity, non-toxic when cured.
   b. Acrylicon Primer
   c. Acrylicon Decor Bodycoat utilizing 1061 SW resin and colored quartz aggregate.
   d. Acrylicon Sealer - colorless, wear resistant

2.02 INTEGRAL RESINOUS BASE

A. Integral Cove Base: Provide manufacturer's standard trowel-applied resinous cove base, chemically bonded to floor system and forming a continuous, seamless transition between horizontal and vertical surfaces.

1. Material: AcryliCon Décor cove material and compatible resin components recommended by manufacturer.

2. Height: 4 inches.
3. Cove Radius: Manufacturer's standard radius, unless otherwise indicated.
4. Finish: Match adjacent resinous flooring in color, texture, and sealer.
5. Provide manufacturer's recommended cove former, backing, reinforcement, and other accessories required to form a smooth, uniform cove.
6. Provide positive termination at top of base in accordance with manufacturer's recommended detail.
7. Form inside and outside corners continuously without open joints.

2.03 JOINT AND CRACK TREATMENT MATERIALS

A. General: Provide joint, crack, and substrate-transition materials recommended by resinous flooring manufacturer and compatible with complete flooring system.

B. Nonmoving Cracks and Construction Joints: Provide manufacturer's recommended resinous repair, reinforcement, or flexible treatment appropriate to substrate condition.

C. Building Expansion, Isolation, and Other Moving Joints: Provide manufacturer's recommended movement-joint treatment. Continue joints through full thickness of resinous flooring system; do not bridge moving joints with rigid resinous flooring.

1. Provide compatible elastomeric joint sealant where required.
2. Provide backer rod, bond breaker, joint-edge treatment, reinforcement, and accessories recommended by flooring manufacturer.
3. Color of exposed joint sealant: Match adjacent resinous flooring as closely as available.

2.04 ACCESSORIES

A. Transition Strips: low and slim profile metal transition or reducer strips.

B. Integral Cove Materials: Manufacturer's standard resin, aggregate, reinforcement, cove former, and accessories required for integral cove-base installation.

1. Cove Mortar: Decor Cove Mix
2. Cove former or backer material as necessary to establish the radius and support the troweled cove.
3. Termination Strip: reglet for upper edge..

C. Sealant: Elastomeric sealant recommended or approved in writing by resinous flooring manufacturer for contact with cured resinous flooring..

D. Joint and Crack Reinforcement: Manufacturer's standard flexible resin, reinforcement fabric, or other materials recommended for conditions encountered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surface is prepared in accordance with Trowel-Applied Flooring manufacturer's written requirements and Section 09 0561 - Common Work Results for Flooring Preparation.

B. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

3.02 INSTALLATION - ACCESSORIES

A. Install manufacturer's standard primers, resins, aggregates, sealers, cove materials, reinforcement, joint materials, termination accessories, and other components required for a complete resinous flooring installation.

B. Install transition strips where flooring terminates to bare substrate or transitions to another floor finish material.

3.03 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness indicated.

C. Finish to smooth level surface.

D. Cove at vertical surfaces unless noted otherwise. Install trowel-applied AcryliCon Décor cove system, chemically bonded to flooring system, with continuous radiused floor-to-wall transition. Install manufacturer's recommended backing/cove former and top-edge termination. Cove height as indicated.

E. Movement Joints: Honor existing building expansion, isolation, and other movement joints through full thickness of resinous flooring system. Do not bridge movement joints with rigid resinous flooring. Install manufacturer's recommended flexible joint treatment, including compatible elastomeric sealant, backer rod or bond breaker, and joint-edge preparation/accessories as required.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, loose laid with edges and control grid adhered.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
E. Section 09 6500 - Resilient Flooring, Base, and Accessories.

1.03 REFERENCE STANDARDS

A. AATCC Test Method 16.3 - Test Method for Colorfastness to Light using Xenon-Arc Lamp; 2014.
B. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.
C. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2014c.
D. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2017a.
E. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.
F. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.
G. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.
I. NFPA 258 - Recommended Practice for Determining Smoke Generation of Solid Materials; 2001.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers. See Section 09 0561 Common Work Results for Flooring Preparation for meeting requirements.
    1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
    2. Review requirements in Section 09 0561 Common Work Results for Flooring Preparation.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Submittals will not be reviewed untill all related flooring system submittals are received.
    1. Substrate Test Results
    2. Carpet Tile
        a. Moisture Mitigation, if required.
        b. Remediation Floor Coating and Underlayment.
        c. Adhesive Product Data& Installation Guides.
        d. Floor Finish Product Data & Installation Guides.
D. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, durability, fade resistance, and method of installation, including recommendations for each type of substrate.
E. Shop Drawings: Indicate layout of joints, direction of carpet pile, and location and type of edge moldings.
    1. When carpet is not fully adhered, clearly indicated which tiles are to be adhered, including perimeter, control grid, sloped surfaces, tiles fitted around mechanical and electrical penetrations, or other conditions recommended by the manufacturer.
F. Selection Samples: For each type where color selection is not indicated or proposed product varies from Basis-of-Design, provide one set of swatches representing proposed product's full range of available colors, patterns, and textures.
    1. Where product specific color, pattern, or texture is indicated, proposed products of other manufacturers must be available in adequately matching color, pattern, and texture, at the sole discretion of the Architect.
    2. Where other non-basis-of-design manufacturers are listed without colors, they may be considered of like quality, but is not meant to imply that those manufacturer's offer adequately matching products for all types required.
G. Verification Samples: Submit two full carpet tiles illustrating color and pattern design for each carpet color selected.

1. When submitting Basis-of-Design products, manufacturer's full-sized digital color prints are acceptable.

H. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

I. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

J. Manufacturer's Qualification Statement.

K. Installer's Qualification Statement.

L. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

M. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience and approved by carpet tile manufacturer.

1.07 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which product manufacturer agrees to furnish to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Tile Carpeting: 20-Year Commerical Limited Warranty
2. Adhesive: 10-Year Commerical Limited Warranty
3. Connectors: 1-Year Commercial Limited Warranty

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpeting, Type CPT-1: Engaged Tufted Pattern Loop, manufactured in one color dye lot.

1. Product: UR103 manufactured by Interface, Inc..
2. Yarn: 100 percent recycled Nylon.
3. Dye Method: Solution dyed.
4. Tile Size: 50 by 50 cm.
5. Color: As indicated on drawings.
6. Pattern: Non-directional.
7. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
8. Smoke Density: less than 450 when tested in accordance with ASTM E662 or NFPA 258.
9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
10. VOC Content: Provide CRI (GLP) certified product.
11. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
12. Machine Gage: 0.10 inch.
13. Tufted Yarn Weight: 28 oz/sq yd.
14. Pile Density: 7,149 oz/cu yd.
15. Light Fastness: Minimum 4.0 at 60 AFU's per AATCC Test Method 16.3.
16. Primary Backing Material: Manufacturer's standard Non-woven recycled vinyl composite, fiberglass reinforced.
17. Secondary Backing Material: CQuest Bio.

B. Tile Carpeting, Type CPT-2: Engaged Tufted Pattern Loop, manufactured in one color dye lot.

1. Product: UR102 manufactured by Interface, Inc..
2. Yarn: 100 percent recycled Nylon.
3. Dye Method: Solution dyed.
4. Tile Size: 50 by 50 cm.
5. Color: As indicated on drawings.
6. Pattern: Non-directional.

7. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
8. Smoke Density: less than 450 when tested in accordance with ASTM E662 or NFPA 258.
9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
10. VOC Content: Provide CRI (GLP) certified product.
11. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
12. Machine Gage: 0.10 inch.
13. Tufted Yarn Weight: 26 oz/sq yd.
14. Pile Density: 7,200 oz/cu yd.
15. Light Fastness: Minimum 4.0 at 60 AFU's per AATCC Test Method 16.3.
16. Primary Backing Material: Manufacturer's standard Non-woven recycled vinyl composite, fiberglass reinforced.
17. Secondary Backing Material: CQuest Bio.

C. Tile Carpeting, Type CPT-3: Engaged Tufted Pattern Loop, manufactured in one color dye lot.

1. Product: UR101 manufactured by Interface, Inc..
2. Yarn: 100 percent recycled Nylon.
3. Dye Method: Solution dyed.
4. Tile Size: 50 by 50 cm.
5. Color: As indicated on drawings.
6. Pattern: By Tile, Non-directional.
7. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
8. Smoke Density: less than 450 when tested in accordance with ASTM E662 or NFPA 258.
9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
10. VOC Content: Provide CRI (GLP) certified product.
11. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
12. Machine Gage: 0.10 inch.
13. Tufted Yarn Weight: 26 oz/sq yd.
14. Pile Density: 6,734 oz/cu yd.
15. Light Fastness: Minimum 4.0 at 60 AFU's per AATCC Test Method 16.3.
16. Primary Backing Material: Manufacturer's standard Non-woven recycled vinyl composite, fiberglass reinforced.
17. Secondary Backing Material: CQuest Bio.

D. Tile Carpeting, Type CPT-4: Engaged Tufted Pattern Loop, manufactured in one color dye lot.

1. Product: WW860 manufactured by Interface, Inc..
2. Yarn: 100 percent recycled Nylon.
3. Dye Method: Solution dyed.
4. Tile Size: 100 by 25 cm.
5. Color: As indicated on drawings.
6. Pattern: Ashlar.
7. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
8. Smoke Density: less than 450 when tested in accordance with ASTM E662 or NFPA 258.
9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
10. VOC Content: Provide CRI (GLP) certified product.
11. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
12. Machine Gage: 0.10 inch.
13. Tufted Yarn Weight: 17 oz/sq yd.
14. Pile Density: 9,415 oz/cu yd.
15. Light Fastness: Minimum 4.0 at 60 AFU's per AATCC Test Method 16.3.
16. Primary Backing Material: Manufacturer's standard Non-woven recycled vinyl composite, fiberglass reinforced.
17. Secondary Backing Material: CQuest Bio.

2.02 ACCESSORIES

A. Transition Strips: Johnsonite Slim Line, SLTC-XX-J and SLT-XX-J.

B. Installation Accessories:

1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

2. Carpet Tile Adhesive: Recommended by carpet tile manufacturer. For use at perimeter and control grid at floating applications.
   a. Adhesive Products; releasable type:
      1) Interface, Inc; Adhesive 2000 Plus: www.interfaceinc.com.
3. Installation Connectors for floating application: Compound acrylic adhesive, applied to PET polyester backing with PET polyester release liner (clear 3" x 3" polyester squares with a small quantity of a pressure sensitive adhesive applied on one side of the polyester film).
   a. Squares connect the carpet modules together to form a stable surface over almost any hard surface.
   b. Connectors shall contain no liquid components and shall have "zero" VOC's when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      1) Tactiles" by Interface

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561 - Common Work Results for Flooring Preparation.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
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 09 0561 - Common Work Results for Flooring Preparation.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.
B. Install carpet tile in accordance with manufacturer's instructions.
C. Blend carpet from different cartons to ensure minimal variation in color match.
D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
E. Lay carpet tile per approved Shop Drawings.
F. Adhere carpet tile to substrate along centerline of rooms, at perimeter of rooms, where tiles are cut, and at 15 foot intervals throughout rooms. Lay remainder of tile dry over substrate using Installation Connectors for floating application.
G. Trim carpet tile neatly at walls and around interruptions.
H. Complete installation of edge and transition strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
B. Clean and vacuum carpet surfaces.

3.05 PROTECTION

A. Prevent all traffic for a minimum of 12-hours and rolling loads for 72-hours to allow the adhesive to cure.
B. Protect flooring from damage during construction operations and placement of equipment and fixtures using Masonite, plywood or a similar product, ensuring first that the flooring surface is free of all debris. Lay panels so that the edges form a butt joint and tape the joint to prevent both movement and debris entrapment underneath. Inspect immediately before covering and after removal.
C. Protect flooring from mars, marks, indentations, and other damage until final acceptance and turnover to Owner.

END OF SECTION

SECTION 09 7200 - WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Felt Wall covering.
C. Wall-mounted felt panels.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 09 2116 - Gypsum Board Assemblies
E. Section 09 9123 - Interior Painting & Transparent Finishing: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes; 2002 (Reapproved 2013).
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Provide data on wall covering and adhesive.
D. Shop Drawings: Indicate wall elevations with seaming layout.
E. Samples: Submit two samples of wall covering, 6 by 6 inch in size illustrating color, finish, and texture.
F. Manufacturer's Installation Instructions: Indicate special procedures.
G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
H. Manufacturer's standard warranty.
I. Installer's Qualification Statement.
J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.
    3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least 10 projects of similar size and scope.

1.06 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing.

1.07 MOCK-UP

A. Provide panel, 6 feet wide, full height, illustrating installed wall covering and joint seaming technique.
B. Locate where directed.
C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.
B. Protect packaged adhesive from temperature cycling and cold temperatures.
C. Do not store roll goods on end.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2.02 FELT WALL COVERINGS

A. Wall Covering - Type WC-2: Wool Felt Wallcovering
1. Product: Filzfelt, Felt by the Yard, 3mm Wool Design Felt
2. Content: 100 percent Merino or Karacul Wol.
3. Performance: 0.10 NRC per ASTM C423.
4. Lightfastness: 40 hours.
5. Thickness: 3mm.
6. Total Weight: 48 oz/sq yd.
7. Roll Width: 70.75 inches.
8. Color: As indicated in Drawings.
9. Trim: As indicated in Drawings.
10. Substrate: wood/plywood.

2.03 WALL MOUNTED FELT PANELS

A. Wall Panels - Type WC-1: Wool Design Felt Tile System
1. Product: Filzfelt, Index Dimensional
2. Content: 100 percent Woold Design Felt, 100 percent biodegradable
3. Substrate: Cork composite, 85 percent pre-consumer recycled content.
4. Performance: 0.10 NRC per ASTM C423.
5. Lightfastness: 40 hours.
6. Tile Thickness: 1/4 to 5/16 inch
7. Tile Size: 24 by 6 inches
8. Color Configuration: one color.
9. Color: As indicated in Drawings.
10. Substrate Finish: wood/plywood.

2.04 ACCESSORIES

A. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
B. Termination Trim: As indicated in Drawings., color as selected.
C. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
D. Substrate Primer and Sealer: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
E. Adhesive Clearning Solution: As recommended by adhesive and wall covering manufacturers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are primed and ready to receive work, and comply with requirements of wall covering manufacturer.
B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Plywood Substrate: Fill and sand joints, fastener heads, voids, and other imperfections flush. Prepare and prime substrate as required by adhesive manufacturer to provide uniform, sound, and nonporous bonding surface.
B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
C. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
B. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
D. Overlap adjacent panels as recommended by manufacturer.
E. Horizontal seams are not acceptable.
F. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
G. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
H. Do not install wall covering more than 1/4 inch below top of resilient base.
I. Apply wall covering to electrical wall plates prior to replacing.
J. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.
K. Install termination trim.
L. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

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SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.
B. Mounting accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Manufacturer's printed data sheets for products specified.
D. Shop Drawings: Fabrication and installation details, panel layout and fabric orientation.
E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
B. Store units flat, in dry, well-ventilated space; do not stand on end.
C. Protect edges from damage.

1.07 MOCK-UPS

A. Construct mock-up of acoustical units at location as indicated by Architect.
    1. Minimum mock-up dimensions; 48 by 60 inches.
    2. Mock-up may remain as part of work.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fabric-wrapped wall panels that fail in materials or workmanship within specified warranty period.
    1. Failures include, but are not limited to, the following:
        a. Fabric sagging, distorting, or releasing from panel edge.
        b. Warping of core.
    2. Warranty Period: Five years from date of substantial completion.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. General:
    1. Prefinished, factory assembled fabric-covered panels.

2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Fabric-Covered Acoustical Panels for Walls:
1. Basis of Design: Kinetics Noise Control; HardSide Acoustical Wall Panels: www.kineticsnoise.com
a. Econetic Core, Econetic High Impact HardSide
2. Panel Core: Manufacturer's standard glass-fiver board, ASTM C 612, molded rigid board, dimensionally stable core.
3. Core Density: 6 to 7 lb/cu ft.
4. Panel Facing: 1/8 inch thick high density impact resistant skin laminated on core face.
5. Sound Absorption: Noise Reduction Coefficient (NRC) of 1.00 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
a. Acoustic Frequency (Hz) Performance:
1) At 125: 0.15
2) At 250: 0.53
3) At 500: 1.09
4) At 1000: 1.21
5) At 2000: 1.09
6) At 4000: 1.00
6. Panel Size: As indicated on Drawings.
7. Panel Thickness: 1-1/8 inches.
8. Edges: Square, perimeter edges reinforced by a formulated resin hardener.
9. Corners: Square.
10. Fabric: As indicated in Drawings, FAB-1 and FAB-2..
11. Mounting Method: Z-clips.

2.02 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
1. Wrap panel edges and return facing fabric minimum 1 inch on back of panel. Fabric corners to be tailored by folding and tucking fabric towards the back. Mitered corners are not acceptable.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Z-clip hanger system.

B. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

C. Sealant: to fix the Z-clips in place once installation is complete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Once set on Z-clip, use sealant to secure panel Z-clips in place..

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
2. Flatness.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
7. Marble, granite, slate, and other natural stones.
8. Floors, unless specifically indicated.
9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
10. Glass.
11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 5000 - Metal Fabrications: Shop-primed items.

C. Section 05 5100 - Metal Stairs: Shop-primed items.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

B. MPI Manual: the “Master Painters Institute Architectural Painting Specification Manual”, current edition.

C. MPI Repainting Manual: the “Master Painters Institute Maintenance and Repainting Manual”, current edition.

D. DSD: Degree of Surface Degradation, as defined by MPI. It shall be the basis of evaluating surfaces for required preparation.

E. Gloss Levels indicated in this section follow the MPI Manual. Traditional gloss levels are included below for reference only.

MPI	Traditional	Gloss @ 60° (ASTM D523)	Sheen @ 85° (ASTM D523)
G1	Matte / Flat	5 maximum	10 maximum
G2	Velvet-like Flat, Eggshell	10 maximum	10-35
G3	Eggshell	10-25	10-35
G4	Satin	20-35	35+
G5	Semi-gloss	35-70	
G6	Gloss	70-85	
G7	High Gloss	85+	

1. Please note that some manufacturers' terms for traditional gloss levels may not coincide with the table above.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D523 - Standard Test Method for Specular Gloss; 2014.

D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

F. SSPC-SP 1 - Solvent Cleaning; 2015.
G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
H. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "acrylic latex").
   2. MPI product number (e.g. MPI #47).
   3. Manufacturer's installation instructions.
C. System Description Letter: on installer's letterhead for each system proposed, including:
   1. Substrate(s).
   2. MPI System designation, where applicable.
   3. Assessment of existing surface condition(s).
      a. Use MPI's DSD designations.
   4. Proposed surface preparation(s).
      a. Existing finished surfaces: Reference MPI Repainting Manual surface preparation procedure numbers.
      b. New, or existing unfinished surfaces: Reference MPI Manual surface preparation procedure numbers.
      c. Where proposed method fails to adequately prepare surface, additional preparation up to and including the most stringent methods appropriate may be required, at no additional cost to the Owner.
   5. List of products to be applied in order from substrate to final coat, including preparation required between coats.
D. Reference Materials: Provide proof of ownership or on-line access to MPI and SSPC Manuals listed in Definitions above.
E. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface, but not less than 30 ft candles over surface to receive finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
   3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
   4. Alternative products listed by MPI in the same category as specified products does not constitute an "equal" under this specification.

B. Paints:
   1. Benjamin Moore: www.benjaminmoore.com
   2. Pittsburgh Paints: www.ppgpaints.com.
   3. Sherwin-Williams Company: www.sherwin-williams.com. (Basis-of-Design for Color Selections)

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
   2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
      c. Architectural coatings VOC limits of NY State.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.
   1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Exterior Plaster and Stucco: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to evaluation.

B. This section outlines minimum preparation guidelines for various substrates, but it is the responsibility of the Contractor to evaluate and prepare surfaces using recommended methods and guidelines per reviewed submittals, industry standards, manufacturer's recommendations, and MPI publications for achieving the best result for each substrate under the project conditions.

1. Contractor shall evaluate condition of surfaces using MPI's DSD rating system.
2. Unless otherwise indicated, Contractors may start with least agressive MPI recommended method they deem appropriate to conditions.
3. Where initial method fails to adequately prepare surface, additional preparation up to and including the most stringent methods appropriate may be required, at no additional cost to the Owner.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

1. Final finish on patched surfaces shall match existing texture.

H. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

1. Final finish on patched surfaces shall match existing texture.

I. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

J. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 SCHEDULE - PAINT SYSTEMS

A. Exterior Gypsum Board: Finish surfaces exposed to view.
   1. Exterior Soffits: GE-OP-3A, flat.

B. Exterior Plaster: Finish surfaces exposed to view.
   1. Exterior Soffits: GE-OP-2L, flat.

C. Steel Fabrications: Finish surfaces exposed to view.
   1. Exterior: ME-OP-3A, gloss; finish all surfaces, including concealed surfaces, before installation.

D. Galvanized Steel: Finish surfaces exposed to view.
   1. Exterior: Paint MgE-OP-3A, gloss.

E. Shop-Primed Metal Items: Finish surfaces exposed to view.
   1. Finish the following items:
      a. Exposed surfaces of lintels.
      b. Exposed surfaces of steel stairs and railings.where indicated on the drawings.
   2. Exterior: Paint-ME-OP-2A, semi-gloss.

3.06 SCHEDULE - MPI SYSTEMS

A. Substrate: Steel and Other Ferrous Metals, Exterior.
   1. Heavy Duty: Water Borne Light Industrial Coating, MPI System EXT 5.1B / REX 5.1K. For use at _____ .
      a. Prep (new surfaces): as recommended by MPI EXT 5.1.
      b. Existing Surface/Finish Condition: Varies, Assume for Bidding at least DSD-3 (Severely Deteriorated).
      c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-7b (Abrasive Blast Cleaning - Metals).
         1) Reference: SSPC-SP 6 (Commercial Blast Cleaning),
      d. Primer: Zinc Rich, Inorganic, MPI #19. Use on new/unpainted surfaces.
         1) Benjamin Moore (does not manufacture an acceptable product in this category)
         2) PPG Amercoat Dimetcote 9 Inorganic Zinc Silicate Primer, D9.
         3) Sherwin-Williams Protective & Marine Zinc Clad XI, B69V11/B69D11.
      e. Primer: Rust-inhibitive, water based, MPI #107. Use on previously painted surfaces.
         1) Benjamin Moore Ultra Spec HP Acrylic Metal primer, 04 Series.
         2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 90-900 Series. (Not MPI #107 Listed)
         3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66x003x0 Series.
      f. Intermediate Coat: match Top Coat.
      g. Top Coat: Light Industrial Coating, Exterior, Water Based, (Gloss Level 5), MPI #163.
         1) Benjamin Moore (does not manufacture an acceptable product in this category)
         2) PPG Pitt-Tech Plus Int/Ext Semi-Gloss DTM Industrial Enamel, Semi-Gloss, 90-1210 Series.
         3) Sherwin-Williams Pro Industrial DTM, Semi-Gloss, B66x0115x Series.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING & TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface evaluation and preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Prime surfaces to receive wall coverings.
3. Mechanical and Electrical:
   a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, electrical equipment, and cable protection sleeves, unless otherwise indicated.
   b. In finished areas, paint shop-primed items.
   c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
   d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do not paint or finish the following items, and protect existing items from painting operations.):

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Fire alarm and data cabling, including fiber optic cables.
6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
7. Marble, granite, slate, and other natural stones.
8. Floors, unless specifically indicated.
9. Ceramic and other tiles.
10. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
11. Glass.
12. Concrete masonry units in utility, mechanical, and electrical spaces.
13. Acoustical materials, unless specifically indicated.
14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements

B. Section 01 8116 - Low-Emitting Materials Restrictions

C. Section 01 8119 - Construction Indoor Air Quality Management

D. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

B. MPI Manual: the “Master Painters Institute Architectural Painting Specification Manual”, current edition.

C. MPI Repainting Manual: the “Master Painters Institute Maintenance and Repainting Manual”, current edition.

D. DSD: Degree of Surface Degradation, on a scale ranging from DSD-0 (Sound Surface) to DSD-4 (Substrate Damage), as defined by MPI. It shall be the basis of evaluating surfaces for required preparation.

E. RSP: Repaint Surface Preparation standards, as defined by MPI. The RSP is typically guided by the DSD level and type of defect or failure identified.

F. Gloss Levels indicated in this section follow the MPI Manual. Traditional gloss levels are included below for reference only.

MPI	Traditional	Gloss @ 60° (ASTM D523)	Sheen @ 85° (ASTM D523)
G1	Matte / Flat	5 maximum	10 maximum
G2	Velvet-like Flat, Eggshell	10 maximum	10-35

G3	Eggshell	10-25	10-35
G4	Satin	20-35	35+
G5	Semi-gloss	35-70	
G6	Gloss	70-85	
G7	High Gloss	85+	

1. Please note that some manufacturers' terms for traditional gloss levels may not coincide with the table above.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.
C. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.
D. ASTM D523 - Standard Test Method for Specular Gloss; 2014.
E. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.
G. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
H. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.
I. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.
J. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.
K. SSPC-SP 1 - Solvent Cleaning; 2015.
L. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
M. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Provide manufacturer's published product data sheet for each product to be used, including:
    1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "acrylic latex").
    2. Manufacturer's written approval for product use compatibility on substrate indicated.
    3. Highlight MPI product number (e.g. MPI #47).
    4. Manufacturer's installation instructions.
    5. Highlight substrates or conditions requiring special preparation.
D. Painting Schedule: prepared by installer for each system proposed, for each substrate, as follows:
    1. Substrate(s).
    2. MPI System designation.
    3. Assessment of existing surface condition(s).
        a. Reference MPI Repainting manual DSD-x designations, noting conditions which fall outside of what would be reasonably expected, or are not as indicated in the documents.
            1) Note: Not all surfaces are visible prior to award. Qualified bidders are assumed to have adequate experience to reasonably infer conditions based on building age, substrate, space type/use, and other observable conditions.
    4. Proposed minimum preparation(s) for previously finished surfaces.
        a. Reference MPI Repainting Manual RSP-x designations.
            1) Reference SSPC-SPx designations where cited by MPI manual for steel prep.
        b. Note: Where multiple options are indicated Contractor may employ any acceptable method. Should proposed method fail to adequately prepare surface, Contractor shall apply more stringent preparation at no additional cost to the Owner.
    5. Proposed minimum preparation for new unfinished surfaces, per MPI Manual. Proposed preparation methods selected by contractor shall adequately prepare surfaces to receive finish indicated.
        a. Reference MPI Manual INT-x designations.
    6. List of products to be applied in order from substrate to final coat, including any steps required between coats.
E. Reference Materials: Provide proof of ownership or on-line access to MPI and SSPC Manuals listed in Definitions above.

F. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, and wood doors, have been approved.

G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface, but not less than 30 ft candles over surface to receive finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
      a. Exception: Specified products noted as "(NOT listed by MPI)" do not require submission as substitutions.
   2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
   3. Substitution of a different paint system using MPI-approved products by the same manufacturer will not be considered.
   4. Alternative products listed by MPI in the same category as specified products does not constitute an "equal" under this specification. Provide products as scheduled.

B. Paints:
   1. Benjamin Moore: www.benjaminmoore.com
   2. Pittsburgh Paints: www.ppgpaints.com/#sle.
   3. Sherwin-Williams Company: www.sherwin-williams.com. (Basis-of-Design for Color Selections)

C. Primer Sealers: Same manufacturer as Topcoats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Where MPI paint numbers are specified without specific product names, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
   2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   5. Supply each paint material in quantity required to complete entire project's work from a single production run.
   6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 50 g/L, maximum.
         3) Opaque, High Gloss: 50 g/L, maximum.
         4) Primers, sealers, and undercoatings: 100 g/L, maximum.
         5) Anticorrosive and Antirust Paints Applied to Ferrous Metals: 100 g/L, maximum.
         6) Zinc-Rich Industrial Maintenance Primers: 100 g/L, maximum.
         7) Pre-treatment Wash Primers: 420 g/L, maximum.
         8) Floor Coatings: 50 g/L, maximum.
         9) Shellacs: 730 g/L, maximum.
      c. Architectural coatings VOC limits of NY State.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Colors: As indicated on drawings.
   1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
   2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under unless otherwise indicated.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Evaluate condition of existing surfaces using MPI's DSD rating guidelines.

C. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors and Traffic Surfaces: 8 percent.
      a. See also 09 0561 - Common Work Results for Flooring Preparation.

3.02 PREPARATION - GENERAL

A. Clean surfaces thoroughly and correct defects prior to application.

B. This specification outlines minimum preparation guidelines for various substrates, but it is the responsibility of the Contractor to evaluate and prepare surfaces using recommended methods and guidelines per reviewed submittals, industry standards, manufacturer's recommendations, and MPI publications for achieving the best result for each substrate under the project conditions.
   1. Notify Prime Contractors responsible for newly installed surfaces which are not ready to receive specified finishes.
   2. Prepare new surfaces according to MPI INT 1.0, INT 1.1, and substrate specific recommendations.
   3. Prepare existing surfaces according to MPI RIN 1.0, RIN 1.1, substrate specific recommendations, and DSD.
   4. Prepare existing surfaces to meet manufacturer's published recommendations prior to application of primer.
   5. Where multiple methods are listed by MPI and Contractor's chosen method fails to adequately prepare surface, additional preparation using alternative methods listed shall be required, at no additional cost to the Owner.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew and algae from impervious surfaces by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry. See MPI RSP-9 (Mildew Treatment).

G. On existing surfaces remove abandoned, non-functioning items, such as surface mounted conduit, raceways, junction boxes, clips, brackets, fasteners, etc. Mechanical, electrical, and plumbing elements shall be removed by the appropriate trade contractors, unless otherwise indicated or directed

3.03 PREPARATION - SUBSTRATES

A. Concrete, Interior. (Non-Walking Surfaces):
   1. Prepare new surfaces per MPI INT 1.1 (Environmental) and INT 3.1 (Concrete Vertical Surfaces).
   2. Prepare existing previously finished surfaces per RIN 1.2 (PH Testing) and RIN 3.1 (Concrete Vertical Surfaces).
      a. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   3. Remove release agents, curing compounds, and simialar contaminates per MPI RSP-13 (Detergent Cleaning).
   4. Remove oils, grease, asphalt, waxes, and similar contaminates per MPI RSP-2 (Solvent Cleaning).
   5. Remove efflorescence and chalk per MPI RSP-8 (Efflorescence Removal).

B. Concrete Masonry Units and Masonry:
   1. Prepare new surfaces per MPI INT 1.1 (Environmental) and INT 4.2 (Concrete Masonry Units).
   2. Prepare existing previously finished surfaces per RIN 1.2 (PH Testing) and RIN 4.2 (Concrete Masonry Units).
      a. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   3. Remove efflorescence and chalk per MPI RSP-8 (Efflorescence Removal).

C. Gypsum Board:
   1. Gypsum board shall be finished in accordance with levels defined in ASTM C840, as follows:
      a. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish (MPI G5 or greater) and as indiicated.
      b. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. All pinholes from pictures, posters, etc. and small holes, cracks, etc. must be filled sanded smooth. All tape and residual adhesive must be removed. Fill cracks, holes and imperfections with patching compound and sand smooth to match adjoining surfaces. Spot prime defects after repair.
      a. Final finish on patched surfaces shall match existing texture.

D. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

E. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

F. Copper: Remove contamination by steam, high-pressure water, or solvent washing.

G. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

H. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Wood Surfaces: For field finishing of wood millwork, casework, trim, etc., refer to AWMAC/WI (NAAWS).

J. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

K. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Remove louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately, including backs and sides.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

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.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied and fully cured.

E. 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.

F. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

G. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

H. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of Topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

I. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

J. Sand wood and metal surfaces lightly between coats to achieve required finish.

K. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

L. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

M. After paint is sufficiently dry, reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner may provide field testing.

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.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from 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. Remove tape, masking, and protective materials including residues.

D. 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.

3.07 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged substrates and finishes after Substantial Completion.

3.08 SCHEDULE - MPI PAINT SYSTEMS

A. Substrate: Concrete, Interior. (Non-Walking Surfaces)

1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 3.1M / RIN 3.1L.
   a. Prep (new surfaces): as recommended by MPI INT 3.1.
   b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
   d. Primer: Alkali Resistant, Water Based, MPI #3. For use at unfinished surfaces with a pH above 10 and less than 13.
      1) PPG: Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI
      2) Benjamin Moore Ultra Spec Interior/Exterior 100% Acrylic Masonry Sealer, 608.
      3) Sherwin-Williams: Loxon Concrete & Masonry Primer, A24W8300 / LX02W0050.
   e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
   f. Intermediate Coat: match Topcoat.
   g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #139. For use at wall plane.
      1) PPG: Prominence Interior 100% Acrylic Latex Satin, 84-3410.
      2) Benjamin Moore: Ultra Spec 500 Interior Eggshell, T538/F538.
      3) Sherwin-Williams: ProMar 200 HP Zero VOC Interior Acrylic Eg-Shel, B20 Series.
2. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 3.1L / RIN 3.1C.
   a. Prep (new surfaces): as recommended by MPI INT 3.1.
   b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
   d. Primer: Alkali Resistant, Water Based, MPI #3. For use at unfinished surfaces with a pH above 10 and less than 13.
      1) PPG: Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI.
      2) Benjamin Moore Ultra Spec Interior/Exterior 100% Acrylic Masonry Sealer, 608.
      3) Sherwin-Williams: Loxon Concrete & Masonry Primer, A24W8300 / LX02W0050.
   e. Intermediate Coat: match Topcoat.
   f. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
      1) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Eggshell, V342.
      2) PPG Pitt-Glaze Interior Pre-Catalyzed Water-Borne Acrylic Epoxy, Eggshell, 16-310 Series.
      3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel, K45-15x Series.
   g. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 5), MPI #153. For use at HM Doors and Frames.
      1) PPG: Pitt-Glaze WB1 Interior Eggshell, 16-310
      2) Benjamin Moore: HP Pre-Catalyzed Waterborne Epoxy Eggshell, HP3320
      3) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45 Series

B. Substrate: CMU, Interior.

1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 4.2E / RIN 4.2L.
   a. Prep (new surfaces): as recommended by MPI INT 4.2.
   b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
   c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than .
   d. Primer: Block filler, Latex, Interior/Exterior, MPI #4. Use on new/unpainted surfaces.
      1) PPG: Speedhide Interior/Exterior Masonry Hi-Fill Latex Block Filler, 6-15XI.
      2) Benjamin Moore: Ultra Spec Masonry Hi-Build Block Filler, 571/K571.
      3) Sherwin-Williams: PrepRite Interior/Exterior Block Filler, B25W00025.
   e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
   f. Intermediate Coat: match Topcoat.
   g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #139. For use at wall plane.
      1) PPG: Prominence Interior 100% Acrylic Latex Satin, 84-3410
      2) Benjamin Moore: Ultra Spec 500 Interior Eggshell, T538/F538
      3) Sherwin-Williams: ProMar 200 HP Zero VOC Interior Acrylic Eg-Shel, B20 Series
2. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 4.2K / RIN 4.2G.
   a. Prep (new surfaces): as recommended by MPI INT 4.2.

b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
d. Primer: Block filler, Latex, Interior/Exterior, MPI #4. Use on new/unpainted surfaces.
1) PPG: Speedhide Interior/Exterior Masonry Hi-Fill Latex Block Filler, 6-15XI
2) Benjamin Moore: Ultra Spec Masonry Hi-Build Block Filler, 571/K571
3) Sherwin-Williams: PrepRite Interior/Exterior Block Filler, B25W00025
e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
f. Intermediate Coat: match Topcoat.
g. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
1) PPG: Pitt-Glaze WB1 Pre-Catalyzed Waterborne Acrylic Epoxy, Eggshell
2) Benjamin Moore: HP Pre-Catalyzed Waterborne Epoxy, Eggshell
3) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel

C. Substrate: Brick Masonry, Interior.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 4.2E / RIN 4.2L.
a. Prep (new surfaces): as recommended by MPI INT 4.2.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than .
d. Primer: MPI #3, Alkali-Resistant Water-Based.
1) PPG: Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI
2) Benjamin Moore: Ultra Spec Masonry Interior/Exterior 100% Acrylic Sealer, 608
3) Sherwin-Williams: Loxon Concrete & Masonry Primer
e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
f. Intermediate Coat: match Topcoat.
g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #139. For use at wall plane.
1) PPG: Prominence Interior 100% Acrylic Latex Satin, 84-3410
2) Benjamin Moore: Ultra Spec 500 Interior Eggshell, T538/F538
3) Sherwin-Williams: ProMar 200 HP Zero VOC Interior Acrylic Eg-Shel, B20 Series
2. Heavy Duty: Water Borne Light Industrial Coating.
a. Prep (new surfaces): as recommended by MPI INT 4.2.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
d. Primer: Block filler, Latex, Interior/Exterior, MPI #4. Use on new/unpainted surfaces.
1) PPG: Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI.
2) Benjamin Moore: Ultra Spec Masonry Interior/Exterior 100% Acrylic Sealer, 608.
3) Sherwin-Williams: Loxon Concrete & Masonry Primer.
e. Primer / Touch Up: match Topcoat. Use on previously painted surfaces.
f. Intermediate Coat: match Topcoat.
g. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
1) PPG: Pitt-Glaze WB1 Pre-Catalyzed Waterborne Acrylic Epoxy, Eggshell.
2) Benjamin Moore: HP Pre-Catalyzed Waterborne Epoxy, Eggshell.
3) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel.

D. Substrate: GWB and Plaster, Interior.
1. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 9.2L / RIN 9.2LL.
a. Prep (new surfaces): as recommended by MPI INT 9.2.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
d. Primer: Latex, interior, MPI #149. Use on new/unpainted surfaces.
1) PPG: Speedhide Zero Interior Zero VOC Latex Sealer, 6-4900XI
2) Benjamin Moore: Ultra Spec 500 Waterborne Interior Primer, N534/K534
3) Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28 Series
e. Intermediate Coat: match Topcoat.
f. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.

1) PPG: Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed Waterborne Acrylic Epoxy, 16-1310.
2) Benjamin Moore: HP Pre-Catalyzed Waterborne Epoxy Eggshell.
3) Sherwin Williams: Pro Industrial Zero VOC Waterbased Epoxy Eg-Shel, B73-360 Series.

E. Substrate: Previously Painted Acoustic Ceiling System (TECTUM), Interior, Dryfall system.
1. Prep:
a. Verify existing TECTUM panels and existing coating are sound and firmly adhered.
b. Remove dust and loose dirt by vacuuming or brushing without damaging wood fibers.
c. Remove loose, peeling, flaking, or poorly adhered coating.
d. Clean localized grease/oil/contaminants as necessary.
e. Do not aggressively sand or otherwise close/damage the porous TECTUM surface.
f. Test adhesion of existing coating and proposed new coating in an inconspicuous area.
g. Verify number of previous field-applied paint coats where reasonably possible. Notify the Architect if six or more layers of previous paint are detected.
2. Primer: as required by coating manufacturer.
3. Intermediate Coat: match Topcoat.
4. Topcoat: Water-Based Dry Fall, (Gloss Level 1), MPI #118.
a. Sherwin-Williams: Waterborne Acrylic Dryfall, B42W1 Series.

F. Substrate: Steel and Other Ferrous Metals, Interior, Dryfall system.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 5.3 dry-fall system for use a metal deck.
2. Prep: as recommended by MPI INT 5.3. SSPC-SP 7 Brush-Off Blast Cleaning.
3. Primer: as required by coating manufacturer.
4. Intermediate Coat: match Topcoat.
5. Topcoat: Water-Based Dry Fall, (Gloss Level 1), MPI #133.
a. PPG: Speedhide Pro-EV Zero Interior Latex Dry-Fog Flat.
b. Benjamin Moore: Latex Dry Fall – Flat 395.
c. Sherwin Williams: Pro Industrial Waterborne Acrylic Dryfall – Flat, B42 Series.

G. Substrate: Steel and Other Ferrous Metals, Interior.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 5.1S / RIN 5.1S
a. Prep (new surfaces): as recommended by MPI INT 5.1.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-4 (Power Tool Cleaning) .
1) Reference: SSPC-SP 3 (Power Tool Cleaning),
d. Primer: Rust-inhibitive, water based MPI #107.
1) PPG: Pitt-Tech Plus EP Red Primer, 90-1908
2) Benjamin Moore: HP Acrylic Metal Primer, HP1100
3) Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66W01310
e. Intermediate Coat: match Topcoat.
f. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 1), MPI #143. For use at ceiling plane.
1) PPG: Manufacturer's current MPI-listed high-performance acrylic, GL1, approved over primed ferrous metal
2) Benjamin Moore: Manufacturer's current MPI-listed high-performance acrylic, GL1, approved over primed ferrous metal
3) Sherwin-Williams: Pro Industrial Acrylic Matte, B66-670 Series
g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 5), MPI #147. For use at HM Doors and Frames.and wall plane.
1) PPG: Pitt-Tech Plus EP DTM Acrylic Semi-Gloss, 90-1610
2) Benjamin Moore: HP DTM Acrylic Enamel Semi-Gloss, HP3310
3) Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss, B66W00651

H. Substrate: Galvanized Metals, Interior.
1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 5.3N / RIN 5.3K.
a. Prep (new surfaces): as recommended by MPI INT 5.3.
b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition, but not less than MPI RSP-4 (Power Tool Cleaning) .
1) Reference: SSPC-SP 3 (Power Tool Cleaning),

d. Primer: Galvanized, water based, MPI #134. Waterborne corrosion-resistant metal primer listed by MPI and specifically recommended by coating manufacturer for galvanized steel.
   1) PPG: Pitt-Tech Plus EP Acrylic Primer, 90-1909 Gray / 90-1912 White, where approved by PPG for galvanized substrate.
   2) Benjamin Moore: HP Acrylic Metal Primer, HP1100, where approved by Benjamin Moore for galvanized substrate.
   3) Sherwin-Williams: Pro Industrial Pro-Cryl Universal Primer, B66W01310.
e. Intermediate Coat: match Topcoat.
f. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 1), MPI #133, Dryfall. For use at ceiling plane.
g. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 4), MPI #140. For use at wall plane.
   1) PPG: Pitt-Tech Plus EP DTM Acrylic Satin, 90-1710
   2) Benjamin Moore: HP DTM Acrylic Enamel, Satin
   3) Sherwin-Williams: Pro Industrial Acrylic, Satin

I. Substrate: Wood: Dimensional Lumber, Dressed Lumber, Wood Paneling and Casework, interior. (Includes columns, beams, joists, exposed decking, wood trim, architectural woodwork, doors, windows, wood-based panel products, plywood, veneer panels, and casework.)
   1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI Systems INT 6.2L / INT 6.3V / INT 6.4T / RIN 6.2P / RIN 6.3V / RIN 6.4D.
      a. Prep (new surfaces): as recommended by MPI INT 6.2.
      b. Existing Surface/Finish Condition: Assume for Bidding at least DSD-2 (Moderately Deteriorated).
      c. Prep (existing previously finished surfaces): as recommended by MPI for surface condition .
      d. Primer: Interior Wood Latex, MPI #39.
      e. Intermediate Coat: match Topcoat.
      f. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 4), MPI #153.
         1) PPG: Pitt-Tech Plus EP DTM Acrylic Semi-Gloss, 90-1610.
         2) Benjamin Moore: COMMAND Waterborne Acrylic Urethane Satin, HP3920.
         3) Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss, B66W00651.

J. Substrate: PVC, Plastics, and Fiberglass, Interior.
   1. Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 6.7CC / RIN 6.7C. For use at Fiberglass.
      Heavy Duty: Water Borne Light Industrial Coating, MPI System INT 6.8CC / RIN 6.8C. For use at PVC and other plastics.
      a. Primer: bonding, water based, MPI #17.
         1) PPG: Glidden Gripper Primer & Sealer Interior/Exterior, GLNGRP100
         2) Benjamin Moore: Fresh Start High-Hiding All Purpose Primer, 046/K046
         3) Sherwin-Williams: Extreme Bond Interior/Exterior Bonding Primer, B51W01150
      b. Intermediate Coat: match Topcoat.
      c. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 3), MPI #151. For use at wall plane.
         1) PPG: Pitt-Glaze WB1 Pre-Catalyzed Waterborne Acrylic Epoxy, Eggshell
         2) Benjamin Moore: HP/COMMAND high-performance waterborne coating, Eggshell, specifically approved for substrate
         3) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel
      d. Topcoat: Light Industrial Coating, Interior, Water Based, (Gloss Level 5), MPI #153. For use at ____ .
         1) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Semi-Gloss, V341. (NOT listed by MPI.)
         2) PPG Pitt-Glaze Interior Pre-Catalyzed Water-Borne Acrylic Epoxy, Semi-Gloss, 16-510 Series.
         3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Semi-Gloss, K46-15x Series.

K. Substrate: ASJ Insulation, and cotton/canvas wrap on piping and ductwork, Interior.
   1. Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 9.2M / RIN 9.2M. For use at ASJ.
      Standard Duty: Institutional Low-Odor/VOC Latex, MPI System INT 10.1D / RIN 10.1DD. For use at cotton and canvas.
      a. Finish same as GWB system above.

END OF SECTION

SECTION 10 1100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.
B. Glass Markerboards.
C. Tackable wallcovering.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard, glass markerboard, tackboard surface covering, trim, and accessories.
D. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.
    1. Include Product Schedule: Use same dsignations indicated on Drawings.
E. Samples: Color charts for selection of color and texture of porcelain enamel steel markerboard, glass markerboard, tackboard surface covering, and trim.
F. Test Reports: Show compliance to specified surface burning characteristics requirements.
G. Manufacturer's Qualification Statement.
H. Warranties: Sample of special warranties.
I. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
C. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
D. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 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.
E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.
    1. Build mockup of typical wall area as shown on Drawings. Include accessories.
    2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Retain paragraph below if natural-slate chalkboards are included or if close tolerances are anticipated.

C. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 50 year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

C. Glass Markerboards: 10 Year Limited Warranty

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: ASTM A 424

1. Shall be enameling grade cold rolled steel manufactured from a minimum of 30 percept post-consumer and post-industrial waste.
2. Enameling grade steel shall be coated with Porcelain Enamel.
3. 3-Coat process shall include:
   a. Bottom Ground Coat – 1.5 to 2.2 mils.
   b. Top Ground Coat – 2.0 to 2.8 mils.
   c. Top Cover Coat – 3.0 to 4.0 mils.
4. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil-thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F.

B. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.

1. Extruded Aluminum: ASTM B 221, Alloy 6063.

C. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

D. Float Glass: Provide float-glass-based glazing unless otherwise indicated.

1. Fully Tempered Safety Glass: Comply with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

E. Extruded Aluminum: ASTM B 221, Alloy 6063.

F. Resilient cork/linoleum Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable finish and integral color throughout.

1. Products:
   a. Forbo, “Bulletin Board”.
   b. Claridge, “Bulletin Board”.
   c. Koroseal Interior Products, “Tac Wall”.

2.02 MARKERBOARD ASSEMBLIES (MB)

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- thick, porcelain-enamel face sheet with high-gloss finish, magnetic.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Clarus
2. Claridge Products
3. Egan Visual Inc.

C. Core: composite wood products to be free of added urea formaldehyde.

1. Hardboard Core: 1/4 inch thick; with 0.015-inch-thick aluminum sheet backing.
2. Particleboard Core: 1/2 inch thick; with 0.015-inch- thick, aluminum sheet backing.
3. Fiberboard Core: 1/2 inch thick; with 0.015-inch- thick, aluminum sheet backing.
4. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.

D. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

E. Sizes: As indicated in Drawings.

F. Accessories:

1. Aluminum Frames and Trim: Factory-applied, fabricated from not less than 0.062 inch thick, extruded aluminum; thin profile, standard shape.

a. Factory Applied Trim: Manufacturer's standard 3/8” trim, profile selected by Architect.
2. Mechanical Fasteners: Concealed Z-clip attachment, exposed brackets are not acceptable.
3. Joinery at Seams:
a. Where one continuous surface is not possible due to size, provide Concealed Aluminum spline bar (visible H spline not acceptable)

G. Magnetic marker holder:
1. Basis of Design: Magnetic Marker Holder by Spectrus Glassboards
a. Size: 3 inches wide by 3.4 inches high by 1.75 inches deep.
b. Color: White
c. Locations:
1) One at each markerboard up to 8’-0” in width
2) Two for each markerboard greater than 8’-0” in width.
2. Markers: manufacturer's standard whiteboard markers. One set per markerboard.

2.03 GLASS BOARD ASSEMBLIES (GL)

A. Magnetic Glass Markerboards: Back-coated glass, laminated to steel.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Basis of Design: Clarus, Depth
2. Claridge Products
3. Egan Visual Inc.
C. Glass Finish: clear glass, back painted to match Pantone 187C.
D. Glass Thickness: 1/4 inch.
E. Finish: Gloss.
F. Steel Backing Sheet Thickness: 24 gauge, 0.0239 inch .
G. Size: As indicated on drawings.
H. Frame: frameless.
I. Mounting: Standoffs, stainless steel.
J. Magnetic marker holder:
1. Basis of Design: Magnetic Marker Holder by Spectrus Glassboards
a. Size: 3 inches wide by 3.4 inches high by 1.75 inches deep.
b. Color: White
c. Locations:
1) One at each markerboard up to 8’-0” in width
2) Two for each markerboard greater than 8’-0” in width.
K. Markers: manufacturer's standard liquid paint and liquid chalk markers. One set per markerboard.

2.04 TACKABLE WALLCOVERING (TAC):

A. Fine-grained homogeneous lineleum cork.
B. Cork Thickness: 1/4 inch.
C. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
D. Size: As indicated on drawings.
E. Edge Molding: Provide metal "J-mold" type edge trim for exposed ends.
F. Manufacturers:
1. Forbo; Bulletinboard.
G. Mounting: Adhesive, as recommended by Manufacturer's written instructions.

2.05 ACCESSORIES

A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
B. Trim: As indicated for each type.

2.06 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
   3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
   4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

2.08 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. 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 boards in accordance with manufacturer's instructions.

B. Install at heights inidicated in drawings.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

3.04 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures.
C. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
D. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
E. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.
F. Selection Samples: Where materials, colors, and finishes are not specified, submit two sets of selection charts or chips.
G. Verification Samples: Submit samples showing colors and finishes specified.
H. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
I. Manufacturer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.
B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:
   1. FASTSIGNS International, Inc; _____: www.fastsigns.com/#sle.
   2. Basis of Design: Takeform; Ethos: www.takeform.net/#sle.
   3. ASI Signage.
   4. ID Signsystems.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.
   1. Use individual metal letters.
   2. Mounting Location: Exterior as indicated on drawings.
   3. Allow for total of 30 letters, 8 inches high and 20 letters 6 inches high.
B. Metal Letters:
   1. Material: Aluminum casting, #514 alloy.
   2. Thickness: 3/4 inch.
   3. Letter Height: 8 and 6 inches.
   4. Text and Typeface:
      a. Character Font: Kabel.

5. Finish: Aluminum vertical finish with clear protective coating.
6. Color: As selected.
7. Mounting: stud mounted on building with 1/4 inch spacers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. 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.

3.03 CLEANING

A. Wash all surfaces clean following installation.

END OF SECTION

SECTION 10 1423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions.
C. Section 01 8119 - Construction Indoor Air Quality Management.
D. Section 09 2116 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

A. Building Code of New York State (BCNYS)
B. American National Standards Institute (ANSI) for ADA Compliance
   1. ICC/ANSI A117.1-2003
C. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
E. ASTM D4802 - Standards for Acrylic material
F. ASTM D1187/D1187M - Stndards for bituminous paint.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures.
C. 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.
D. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
   2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
      a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
      b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
      c. Submit for approval by Owner through Architect prior to fabrication.
E. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
F. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.
G. Verification Samples: Submit samples showing colors, materials, and finishes specified.
H. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
I. Manufacturer's qualification statement.
J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 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.

1.07 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.

1.08 WARRANTY

A. Specialty Warranty: Manufacturer agrees to repair or replace components of signs that constitute materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:
   a. Deterioriation of finishes beyond normal weathering.
   b. Deterioriation of embedded graphic image.
   c. Separation or delamination of sheet materials and components.
2. Warranty Period: 5 Years from Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signage:

1. Inpro Corporation; _____: www.inprocorp.com/#sle.
2. Takeform; ____: www.takeform.net/#sle. (Basis of Design)
3. ID Sign Systems

2.02 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.

2.03 PANEL SIGNAGE

A. Panel Signage: Signage without frame.

1. Application: Room and door signs.
2. Description: Flat signs with applied character panel media, tactile characters.
   a. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille; in adherence to ADA Specifications.
   b. Signage shall be capacble of accepting direct prints including colors, patterns, graphic images and photography. Prints shall be second surface to protect from scratches, fading or other damage.
   c. All Signage, including but not limited to room ID's, directionals, and directories, shall have matching appearance and constructed utilizing the same manufacturing process to ensure a consistent look throughout.
   d. The entire sign shall be 65% post industrial waste and 100% recyclable under Code 7.
3. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
4. Flammability: Class "A" - Flame Spread 0-25, Smoke developed 250 or less.
5. Thickness: Manufacturer's standard for size of sign.
6. Sign Edges: Squared.
7. Letter Edges: Squared.
8. Corners: Squared.
9. Color and Font, unless otherwise indicated:
   a. Character Font: Helvetica Medium.
   b. Character Case: Upper case only.
   c. Background Color: White.
   d. Character Color: Red matching Cornell University brand color.
10. Materials
    a. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV Filtering).
       1) Signage shall be fabricated of acrylic,.375 inch thick, comprised of two layers. Edges shall be smooth without chips, burrs, sharp edges or marks. The direct print shall be second surface to prevent scratching, fading, or other damage.
       2) Acrylic shall be non-glare optically clear with a P99 finish assuring no loss of clarity or composition of the print.
       3) Tactile lettering shall be precision machined, raised 1/32 inch, matte PETG and subsurface colored for scratch resistance.

4) The signage shall utilize a pressure activated adhesive. The adhesive shall be nonhazardous and shall allow for flexing and deflection of the adhered components due ot changes in temperature and humidity without bond failure.
5) Signage shall have an acrylic shim plate. The shim shall lift the sign off the wall to facilitate cleaning and painting without sign removal.

11. Printed Inserts:
    a. The signage shall be capable of accepting paper inserts to allow changing and updating as required. Insert components shall have a 0.040 inch thickness non-glare acrylic window and shall be flush to sign face for a smooth, seamless appearance.
        1) Acylic Window to be fully removable.
    b. Manufacturer shall provide a template containing layout, font, color, artwork, and trim lines, to all Owner to produce inserts on have a 0.040 inch thickness non-glare acrylic window and shall be flush to sign face for a smooth, seamless appearance.
12. One-Sided Wall Mounting: Tape adhesive.

2.04 ACCESSORIES

A. LEED Plaque mounting hardware
    1. Stainless steel standoffs, 25mm diameter, 25mm wall offset.
    2. Suitable for plaque thickness.
B. Back panel for glass mounted signs: At locations mounted on transparent glass, acrylic sheet matching size, thickness, color, and material of signage panel to be provided and mounted to glass aligning with panel sign.
C. Tape Adhesive: Double-sided tape, permanent adhesive.
D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. 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. Install back panel for glass mounted signs to align with sign panel.
D. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
    1. Moutning height to be 55 ionches above finished floor to the baseline of the lowest braille cell.
E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

PART 4 SIGN TYPE SCHEDULE

4.01 PANEL SIGNS

A. Quantities and locations as indicated in drawings unless noted otherwise.
B. Type 1: Room Identification Sign with one Line of Copy and one line of braille with changeable insert
    1. Size: 4"H x 8"W
C. Type 2: Room Identification Sign with two lines of Copy and one line of braille.
    1. Size: 4"H x 8"W
D. Type 3: Toilet Room sign with pictogram, with one line of Copy and one line of braille.
    1. Size: 8"H x 8"W
E. Type 4A: Elevator sign with pictograms as indicated, one line of Copy and one line of braille.
    1. Size: 10"H x 8"W
F. Type 4B: Elevator emergency sign
    1. Size: 10"H x 8"W
G. Type 5: Exit identification sign with one line of copy and one line of braille, and pictogram, arrow, and one line of braille to accessible exit
    1. Size: 2"H x 8"W
H. Type 6: Exit identification sign with one line of copy and one line of braille.
    1. Size: 2"H x 8"W
I. Type 7: Fire extinguisher identification sign with one line of copy and one line of braille.

1. Size: 8-1/2"H x 3"W

J. Type 8: Projecting Fire Extinguisher location sign
   1. Size: 8"H x 6"W per face

K. Type 9: Sign Holders for 8-1/2” x 11” Inserts
   1. Configuration: Double Layer sign with 11" high x 8-1/2"wide clear window for paper insert
   2. Quantity: 10

L. Interior Emergency Phone sign

M. No Food or Beverages Permitted sign

N. LEED Plaque
   1. Hardware & installation by contractor, plaque by owner.

4.02 EXTERIOR SIGN TYPES

A. No smoking within 25ft of building sign
   1. Quantity: 3.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.
B. Protective wall covering.
C. Protective wall panels.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.
B. Section 01 8113 - Sustainable Design Requirements
C. Section 01 8116 - Low-Emitting Materials Restrictions
D. Section 01 8119 - Construction Indoor Air Quality Management
E. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010.
B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2014.
C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.
D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
D. Shop Drawings: Include plans, elevation, sections, and attachment details.
E. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
    1. See Section 01 6000 - Product Requirements, for additional provisions.
H. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
B. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a one year period after Date of Substantial Completion.
C. Provide five year manufacturer and installer warranty for metal crash rails.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
    1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
    2. Inpro; _____: www.inprocorp.com/#sle.
B. Protective Wall Covering (FRP-1):
    1. Construction Specialties, Inc; _____: www.c-sgroup.com/#sle.

2. Inpro; _____: www.inprocorp.com/#sle.

C. Protective Wall Panels (SSM-2):

1. Wilsonart Solid Surface

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted:

1. Material: Type 304 stainless steel, No. 4 finish, 16 ga.
2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
3. Width of Wings: 2 inches.
4. Corner: Square. with tapered ends
5. Color: As indicated.
6. Length: One piece, 68 inches.
7. Angle: 90 degrees, and custom 120 degrees, as indicated in Drawings.
8. Mounting: Adhesive, as required by Manufacturer's written instructions.

B. Protective Wall Covering:

1. Material: PVC-free, impact-resistant, thermoplastic.
2. Basis of Design: Construction Specialties, Acrovyn rigid sheet wall covering.
3. Thickness: 0.060 inch.
4. Color: As selected from manufacturer's standard colors.
5. Pattern: None.
6. Texture: Suede.
7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
   a. Inside Corner Trim: Standard angle
   b. Outside Corner Trim: Standard angle.
   c. Wainscot Top Trim: Standard cap.
8. Mounting: Adhesive, as required by Manufacturer's written instructions.
   a. Acrovyn Interiors Heavy Duty Water-Based Mastic Adhesive.
9. Primer: PVA-fee, as recommended by Manufacturer's written instructions.

C. Protective Wall Panels:

1. Material: Solid surface material wall cladding with trim accessories
2. Thickness: 1/4 inch.
3. Panel Size: 60 by 98 inch.
4. Color and Pattern: As indicated on drawings.
5. Accessories: aluminum _____ trim and moldings.
   a. Cove Transition Trim at Floor: Schluter DILEX-AHKA.
   b. Top Trim: Schluter VINPRO-S
6. Joint Sealant: mildew-resistant, 100 percent silicone/elastomeric sealant compliant with ASTM C920.
7. Mounting: Adhesive.
   a. Manufacturer-recommended, permanently flexible silicone or elastomeric adhesive suitable for bonding solid-surface sheet to specified wall substrate

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Corner Guards:

1. Position corner guard 4 inches above finished floor to 72 inches high.
2. Apply adhesive in accordance with manufacturer’s written instructions to provide secure, permanent attachment without exposed fasteners. Maintain full contact with substrate and hold in position until adhesive has cured.

C. Protective Wall Covering:

1. Install protective wall covering in accordance with manufacturer’s written instructions and approved shop drawings. Install panels plumb, level, securely attached, and in proper relationship to adjacent construction.
2. Direct-adhere panels to substrate using adhesive. Apply adhesive uniformly using manufacturer-recommended application method and coverage to provide complete, permanent attachment. Do not install over unsuitable or improperly prepared substrates.
3. Cut and fit panels accurately around openings, penetrations, fixtures, and adjacent construction. Provide clearances and expansion allowances in accordance with manufacturer’s written instructions. Roll or press panels firmly into adhesive to achieve uniform bond and eliminate air pockets.
4. Install manufacturer’s standard trim at panel edges, joints, inside and outside corners, and terminations as indicated. Fit panels into trim with required clearance for thermal expansion. Install trim straight, securely attached, and with tight, neat intersections. Miter or cope trim at intersections where required for a finished appearance.
5. Terminate panels neatly at resilient base and adjacent finishes as indicated. Coordinate panel and trim installation with base, door frames, casework, countertops, and other adjoining construction to provide clean, continuous transitions.

D. Protective Wall Panels:

1. Install solid-surface wall panels in accordance with manufacturer’s written instructions and approved shop drawings. Install panels plumb, level, securely attached, and in proper relationship to adjacent construction. Maximum panel width to be 60 inches or as recommended by manufacturer's written instructions.
2. Direct-adhere solid-surface panels to substrate. Apply adhesive in beads or pattern and at spacing recommended by manufacturer to provide secure attachment while allowing for thermal movement. Do not full-spread adhesive unless specifically recommended by manufacturer.
3. Position panels without forcing or rigidly restraining material. Provide clearances and expansion allowances recommended by manufacturer at panel perimeters, penetrations, corners, and transitions to adjacent materials. Temporarily brace or secure panels as required until adhesive has fully cured.
4. Install top trim and base cove trim.
5. Joints: Provide nominal 1/8-inch joints between panels and at transitions to adjacent materials unless otherwise indicated. Fill exposed panel joints and joints between trim and panels with sealant. Tool joints smooth and flush with panel faces.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. Remove excess adhesive and other installation residue without damaging exposed surfaces.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.
B. Under-lavatory pipe supply covers.
C. Diaper changing stations.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements.
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 09 3000 - Tiling:
E. Section 22 4000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. Cornell University Standard ADA Mounting Height Diagram
C. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011.
D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
E. ASTM C1036 - Standard Specification for Flat Glass; 2025.
F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
G. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures.
C. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
D. Shop Drawing: Indicating sizes, locations, and installation methods.
E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
    1. Georgia-Pacific Professional; _____: www.blue-connect.com/#sle.
    2. Slim Jim
    3. Impact Products
    4. Bobrick

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
    1. Grind welded joints smooth.
    2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
B. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.
C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
D. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Products are to be Owner furnished, Contractor installed, unless noted otherwise.
B. Paper Towel Dispenser: Georgia Pacific-54338A
   1. Push handle type
C. Waste Container: Slim Jim RMD 3540, 23-Gallon Brute RMD2632
D. Hand Soap Dispenser: Deb Soap - Proline Curved White, with Cornell University Logo
   1. 1-liter unit, SBS 91128
E. Toilet Tissue Holder: Georgia Pacific Compact Coreless Tissue Fixture
   1. Surface mounted, double toilet tissue roll type, specific for ADA compliant installation.
F. Sanitary Napkin Dispensers: Bobrick B370639 Trimline Series
   1. Surface mounted, ADA compliant fixture and dispenser actuation.
   2. Type that dispenses a minimum of two products (tampons and napkins)
   3. Locations: women's gang toilet room.
G. Sanitary Napkin Disposal: Impact Products 25125200.
   1. Surface mounted, white plastic, self-closing panel, ADA compliant. smooth texuture.
   2. Locations: women's gang toilet room.
H. Coat Hooks: Bobrick B-682.
I. Grab Bars: Stainless steel, smooth surface.
   1. Contractor Furnished, Contractor Installed.
   2. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Contractor Furnished, Contractor Installed.
B. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
   3. Construction: 1/8 inch flexible PVC.
      a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      b. Comply with ASTM C1822, type indicated.
      c. Comply with ASME A112.18.9.
      d. Comply with ICC A117.1.
   4. Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

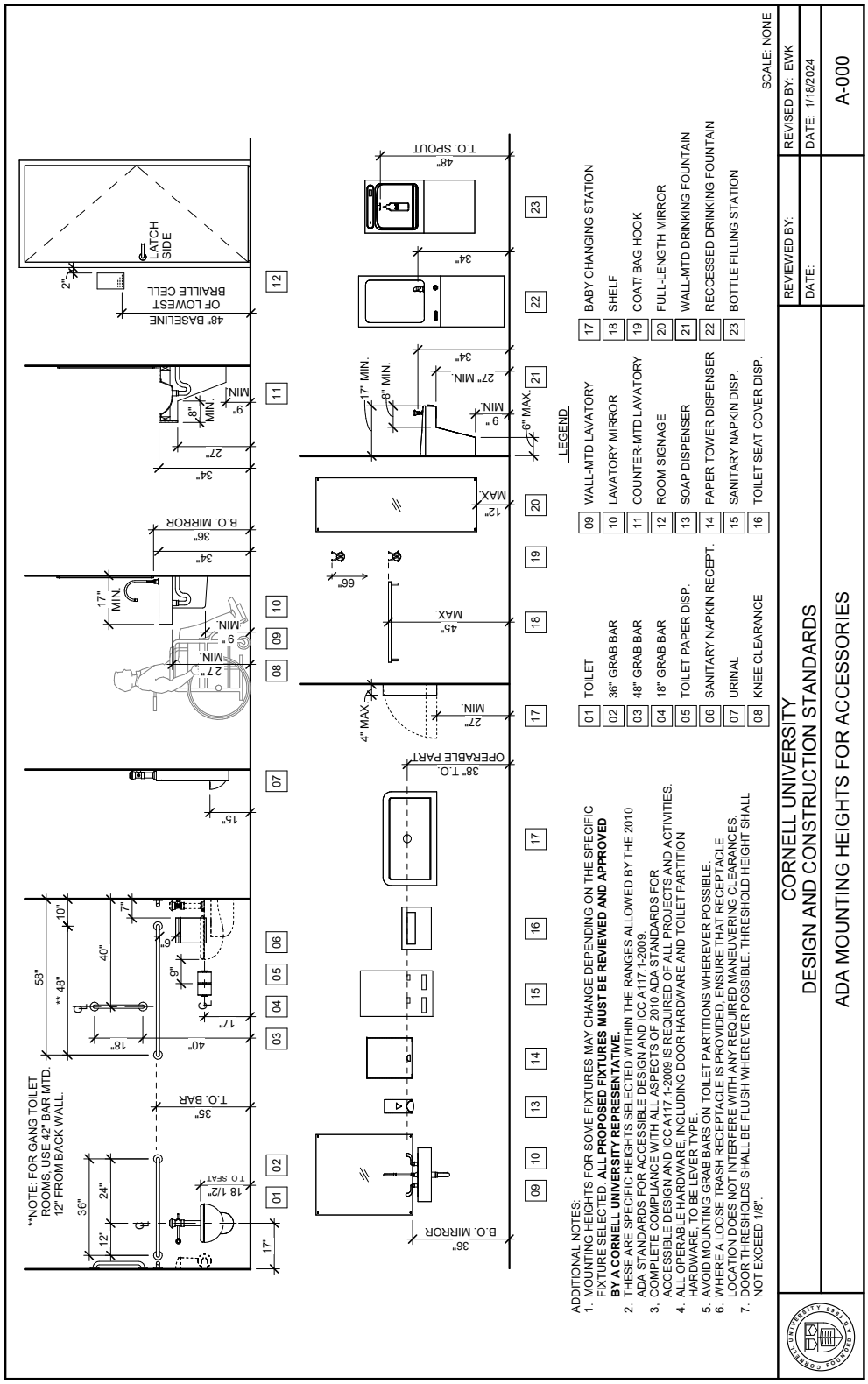
B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations and Cornell University Standard ADA Mounting Height Diagram, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

PART 4 CORNELL UNIVERSITY STANDARD ADA MOUNTING HEIGHT DIAGRAM



END OF SECTION

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.
B. Fire extinguisher cabinets.
C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.
B. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide extinguisher ratings and classifications, color and finish, and anchorage details.
C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Amerex Corporation; : www.amerex-fire.com.
   2. J. L. Industries, Inc.; a division of Activar Construction Products Group; : www.activarcpg.com.
   3. Larsen's Manufacturing Company; : www.larsensmfg.com.
B. Fire Extinguisher Cabinets and Accessories:
   1. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   2. Modern Metal Products, Division of Technico, Inc.; www.modern-metal.com.
   3. Nystrom, Inc: www.nystrom.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Cartridge Operated: Spun shell.
   2. Stored Pressure Operated: Deep Drawn.
   3. Class: A:B:C type.
   4. Size: 2.5 pound.
   5. Finish: Baked polyester powder coat, color as selected.
   6. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   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).
B. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
C. Door Material: Stainless Steel

D. Door Style: Solid opaque panel with frame
E. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
F. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
G. Door Fabrication: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
    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.
H. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
I. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

2.04 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with black baked-enamel finish.
B. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
C. Fire Blanket: Fire retardant treated wool; red, 62 by 84 inch size.
D. Cabinet Signage: -.
    1. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced red lettering in accordance with authorities having jurisdiction (AHJ).

2.05 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
    1. Run grain of directional finishes with long dimension of each piece.
    2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
    1. Remove and replace damaged, defective, or undercharged fire extinguishers.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 5613 - METAL STORAGE SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted adjustable metal shelving.
B. Shelving accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 06 1000 - Rough Carpentry: Blocking and reinforcement in walls for anchoring shelving units.
E. Section 09 2116 - Gypsum Board Assemblies: Blocking and reinforcement in walls for anchoring shelving units.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures.
C. Product Data: Manufacturer's data sheets on each product to be used, including:
    1. Rated uniform shelf loads.
    2. Details of shelving assemblies, including reinforcement.
    3. Accessories.
    4. Installation methods.
D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.
    1. Indicate methods of achieving specified anchoring requirements.
E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged units.
B. Store in manufacturer's unopened packaging until ready for installation.
C. Store under cover and elevated above grade.

1.06 WARRANTY

A. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.01 WALL MOUNTED ADJUSTABLE METAL SELVING

A. Manufacturers:
    1. JW Metal Products / Stainless Supply.
    2. McMaster-Carr.
    3. Mott Manufacturing.
    4. Bench Pro, Inc.
B. Shelving: solid and perforated metal shelves with 1 inch backstop.
    1. Material: 18 ga. heavy reinforced stainless steel, Grade 304, brushed finish.
    2. Size: provide custom sizes if not manufacturer's standard size.
        a. In 101C Clay Studio: 32 inch and 48 inch long by 24 and 18 inch deep.
        b. In 101A Making Exploration Annex: 48 inch long by 12 inch deep.
    3. Edges: Square cut edge
    4. Perforation:
        a. In 101C Clay Studio: Solid, no peforations.
        b. In 101A Making Exploration Annex: 1/2 inch diameter hole perforations

C. Standards and Brackets:
   1. Size and quantity as required to support shelving depths indicated and for 400 pound load capacity per bracket pair.
   2. Material: stainless steel.
   3. Standards: Double slotted with 7/8 inch increment slots, height as indicated in Drawings.
   4. Brackets: double pong with locking tab.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level and that clearances are as specified.
B. Verify that walls are suitable for shelving attachment.
C. Do not begin installation until substrates have been properly prepared.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.

3.04 CLEANING

A. Clean shelving and surrounding area after installation.

3.05 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

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Provide labor, materials and equipment necessary to provide the pipe grid as indicated.

B. Related work as specified elsewhere:
   1. Section 05100-Structural Metal Framing
   2. Section 09900-Paint

1.03 PERFORMANCE REQUIREMENTS

A. Pipe grid shall withstand structural loads indicated using allowable design working stresses of material specified. Pipe grid shall be designed for a live load of 10 pounds per square foot. Factor of safety shall be 8.

1.04 SUBMITTALS

A. Shop drawings indicating layout, design details, materials, and method of construction.

1.05 QUALIFICATIONS

A. Installer Qualifications: Installer shall be experienced in providing and installing equipment of the kind indicated and shall have a record of successful in-service performance.

PART 2-PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Pipe grid shall be installed at elevation appropriate for the function approved by the architect.

B. Pipe grid shall consist of 2 sets of pipe battens installed (in plan) perpendicular to each other. Individual pipe battens in each set shall be located on 5-feet centers. End of pipe battens shall rest on clip angles (3" x 2" x ¼") on all sides of studio that have masonry walls secured in place by means of "U" bolts at ends of pipes.

C. Pipe battens that compose the grid (in both directions) shall consist of 1½" O.D. steel pipe (schedule 40) with battens that span from wall to wall or as shown in the drawings.

2.02 HANGERS

A. Grid shall be supported by means of ¼-inch welded link proof coil chain hangers or as detailed. Entire grid shall be assembled into a unit structure. Hangers shall be located on centers not to exceed 10 feet.

B. At every point where pipe battens intersect (in both directions) a fitting shall connect the two perpendicular pipes into a rigid assembly.

C. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperature. Attach hangers to structural members. After installation this contractor shall test working parts, correcting any items needing adjustment to assure easy and efficient operation.

2.03 LOADS

A. Pipe batten loads shall be referred to the overhead structure. Miscellaneous angles and channels as required shall be provided to refer the hanger loads to the structure.

B. Fittings that connect the pipe battens at each intersection shall be formed to the precise size of the pipe battens and the two halves of the fitting shall be bolted together with (4) 3/8-inch, grade 5 bolts secured with lock nuts.

PART 3-EXECUTION

3.01 INSTALLATION

A. Coordinate work with other trades doing adjoining work to assure proper fit, installation, and first class results.

B. Where width of ducts and other building equipment interferes with locations of hangers at spacing required by standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support the loads within performance limits.

END OF SECTION

SECTION 11 5213 – PROJECTION SCREENS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Roll-up, electrically operated projection screens

1.02 RELATED DOCUMENT

A. The specifications sections "General Conditions", "Special Requirements" and "General Requirements" form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

B. Drawings and Division 00 and 01 Specification Sections, apply to this Section.

1.03 RELATED SECTIONS

A. Division 5 - Metal Fabrications: Suspension systems for projection screens.

B. Section 064000 – Architectural Woodwork

C. Section 090000 – Finish List

D. Section 092100 – Plaster and Gypsum Board Assemblies

E. Section 092226 – Suspension Systems

F. Section 092613 – Gypsum Veneer Plastering

G. Section 095000 – Ceilings

H. Division 26 for electrical wiring, connections, and installation of remote-control switches for electrically operated projection screens.

1.04 REFERENCES

A. NFPA 70 - National Electrical Code

B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films

C. GREENGUARD Environmental Institute Gold

D. US Green Building Council

E. International Code Council (ICC):
   1. International Building Code.

F. Society of Motion Picture and Television Engineers (SMPTE):
   1. SMPTE RP 94-2000, Gain Determination of Front Projection Screens.

G. Underwriters Laboratories Inc. (UL).

1.05 SUBMITTALS

A. Submit in accordance with Section 01 Submittal Procedures:
   1. List of proposed products and product data.
   2. Shop drawings showing dimensions, method of attachment, structural support, bracing, and electrical wiring.
   3. Samples of finishes for selection by Architect.
   4. Manufacturer's installation and maintenance instructions.
      a. Wiring diagram for electrically operated units.
   5. Shop Drawings: Shop drawings showing layout and types of projection screens. Show the following:
      a. Location of screen centerline.
      b. Location of wiring connections.
      c. Detailed drawings for concealed mounting
      d. Connections to suspension systems
      e. Anchorage details
      f.Accessories

1.06 QUALITY ASSURANCE

A. Source limitation: Obtain projection screens from single manufacturer as a complete unit including necessary mounting hardware, motor, controls, limit switches, and accessories.

B. Motorized projection screens shall be certified for use in the United States and Canada by Underwriters Laboratory (UL), Inc. and shall bear UL label.

1.07 DELIVERY, STORAGE AND HANDLING

A. Store projection screens in a dry, ventilated area, protected from exposure to harmful weather conditions, at a temperature less than 80 degrees F (27 degrees C).

B. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to begin.

C. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

D. Protect screens from damage during delivery, handling, storage, and installation.

1.08 PROJECT AMBIENT CONDITIONS

A. Project Location: Perform electrically operated projection screen work when temperatures are greater than 40 degrees F (4 degrees C).

1.09 COORDINATION

A. Coordinate work with installation of ceilings, walls, electric service power characteristics, and location.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Base specification

1. Da-Lite Screen Company; P.O. Box 137, 3100 N. Detroit St., Warsaw, IN 46581-0137; Telephone: (800) 622-373; Web: https://www.legrandav.com/

B. Other Acceptable manufacturer

1. Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425; Spiceland, IN 47385-0425. ASD. Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Web: www.draperinc.com.
2. Stewart Filmscreen Corporation, which is located at 1161 Sepulveda Blvd. Torrance, CA 90502-2737 Toll Free Tel: 800-762-4999; https://www.stewartfilmscreen.com/

C. Substitutions

1. Requests for substitutions will be considered in accordance with provisions of Section 002600.

2.02 SCREEN TYPE A – MOTORIZED FRONT PROJECTION SCREEN

A. Ceiling Mounted Electrically Operated Projection Screens.

1. Screen Operation: Electrically operated, UL and ULC listed, retractable, with rigid metal roller.
2. Motor: Housed inside metal roller. Includes automatic thermal overload protection, integral gears, capacitor and electric brake to prevent coasting, and preset, adjustable limit switches to automatically stop viewing surface in the UP or DOWN positions.
    a. Type: 3-wire, permanently lubricated, reversal type designed for mounting inside roller and to suit project requirements.
    b. Voltage, Frequency: 115 V, 60.
    c. Amperage: 2.4 amps maximum.
3. Electric Controls: Wall-mounted switch.
    a. Voltage, Frequency: 115 V, 60 Hz.
    b. Switch: 3 position type with cover plate for UP, DOWN and STOP functions.
    c. Junction Box: Internally attached to screen case.
4. Screen Mounting: Ceiling suspended.
    a. Mounting Hardware: Include mounting hardware.
5. Screen Case: Designed to receive mounting hardware and sized to suit projection screen.
    a. Material: Extruded aluminum.
        1) Design: 2-piece with curved contour flat-backed style with heavy-duty end caps concealing roller ends.

2) Case Length: Refer to Drawings

6. Screen Size: Refer to Drawings
7. Acceptable Material: Da-Lite Screen Company, Inc. Tensioned Contour Electrol Projection Screen.
    a. Screen Material:
        1) Front projection, flame retardant, mildew resistant vinyl, with black backing and with standard black borders, easily cleaned with mild soap and water solution.
        2) Bottom end of fabric to be inserted into a custom aluminum slat bar with added weight to provide vertical tension on the screen surface.
        3) Seamless in all sizes.
    b. Acceptable Viewing Surface: Da-Lite Screen Company, Inc.:
        1) Refer to Drawings
8. Screen Drop: Black Drop: Refer to Drawings.
9. Low Voltage Control (LVC) System:
    a. Single Motor Low Voltage Control (LVC) System: Internal.

2.03 SCREEN TYPE B – MANUAL FRONT CHROMA KEY SCREEN

A. Wall or Ceiling Mounted Manual Projection Screens.
1. Screen Operation: Heavy-duty spring-roller operated, manually retractable projection screen with positive stop action at viewing positions. Screen shall be free-hanging and suitable for wall or ceiling mounting.
2. Roller Assembly:
    a. Type: Heavy-duty spring roller with manual pull operation.
    b. Operation: Smooth deployment and retraction with positive stopping positions.
3. Screen Mounting: Wall-mounted or ceiling-mounted as indicated on Drawings.
    a. Mounting Hardware: Integral universal end-cap mounting brackets. Optional floating mounting brackets available.
4. Screen Case: Designed to receive mounting hardware and sized to suit projection screen.
    a. Material: Steel.
        1) Design: Scratch-resistant steel case with matching end caps concealing roller ends.
        2) Finish: White polyester finish; black finish available upon request (Verify w/Architect)
        3) Case Dimensions: 5-7/8 inches high x 5-1/4 inches deep.
        4) Case Length: Refer to Drawings.
5. Screen Size: Refer to Drawings.
6. Acceptable Material: Draper, Inc. Luma 2 Manual Projection Screen.
    a. Screen Material:
        1) Front projection viewing surface with fiberglass backing to maintain flatness and resist distortion.
        2) Flame- and mildew-resistant screen material.
        3) Bottom of viewing surface secured to weighted dowel for improved hanging flatness.
    b. Acceptable Viewing Surface:
        1) Refer to Drawings
7. Screen Drop: Refer to Drawings.
8. Accessories:
    a. Operating Pole: Aluminum, 4-foot or 6-foot length

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate layout and installation of projection screens with ceiling construction and related components penetrating or above ceilings such as lighting fixtures, mechanical equipment, ductwork, and fire-suppression system.

B. Coordinate requirements for blocking, structural supports, and bracing to ensure adequate means for installation of screens.

C. Coordinate requirements for power supply conduit, and wiring required for projection screen motors and controls.

D. Coordinate installation of recessed mounted screens with construction of suspended acoustical panel ceilings. Where acoustical ceiling panels are to be adhered to screen case closure, provide and coordinate required tolerances and weight restrictions.

E. Clean surfaces thoroughly prior to installation.

F. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.02 INSTALLATION

A. Install projection screens and controls at locations and heights indicated on Drawings.

1. Adjust the UP-limit switch to the fully up position. Reference manufacturer instructions.
2. Adjust the DOWN limit switch such that the bottom of the viewing surface is at the height indicated on drawings.

B. Comply with screen manufacturer's written instructions and shop drawings.

C. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.

1. If the screen presents an uneven or rippled surface after sitting in the down position for five minutes and the screen is so equipped, consult with the manufacturer to adjust the tab tensioning system.

3.03 TESTING AND DEMONSTRATION

A. Test motorized projection screens to verify that screen, controls, limit switches, closure, and other operating components are functional. Ensure that screen is level and viewing surface plumb when extended. Correct deficiencies.

B. Demonstrate operation of screen to Owner's designated representatives.

3.04 PROTECTING

A. Protect projection screens after installation from damage from construction operations.

B. If damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 12 2400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.
B. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.
C. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.
D. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, installation and maintenance instructions, and accessories.
D. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
F. Selection Samples: Include fabric samples in full range of available colors and patterns.
G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
I. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
J. Maintenance contracts.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.
    1. Manufacturer's authorized representative.
    2. Factory training and demonstrated experience.
C. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
B. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
C. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits including but not limited to ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.08 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Mounting Hardware, Headbox, Rollers, Roller-Coupling Assemblies and Clutch: Twenty-Five (25) years.
   2. Spring assist mechanism used in any window treatment product: Ten (10) years.
   3. PVC-Free Fabric: Five (5) years.
   4. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   3. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades:
   1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Roll Direction: Roll down, closed position is at window sill.
      c. Mounting: Window jamb mounted - inside, between jambs.
      d. Size: As indicated on drawings.
      e. Fabric: As indicated under Shade Fabric article.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes: As required for type of shade operation.
      a. Material: Extruded aluminum, clear anodized finish.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
      a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
      b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
   5. Manual Operation for Interior Shades:
      a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
      b. Drive Chain: Continuous loop beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops so that shade stops when fully in room-darkening bottom slot without puddling, and stops at 1-1/2 inches below roller.
      c. Chain Retainer:
         1) Chain tensioning device complying with WCMA A100.1.
   6. Accessories:
      a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
      b. Interior Side Channels: As required for light sealing room-darkening shade applications.
      c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric for Room-Darkening Shades: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Basis of Design: Mermet, Spart Twilight.
   2. Material: 33 percent polyester, 67 percent acrylic

3. Performance Requirements:
    a. Flammability: Pass NFPA 701 large and small tests.
    b. Fungal Resistance: No growth when tested according to ASTM G21.
4. Openness Factor: 0 percent.
5. UV Blockage: 100 percent.
6. Weight: 9.9 ounces per square yard.
7. Roll Width: 126 inches.
8. Color: As selected by Architect from manufacturer's full range of colors.
9. Backing: Color Matching.
10. Fabrication:
    a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

2.04 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and fit securely in light sealing channels, measured at 74 deg F:

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

C. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 12 3100 - MANUFACTURED METAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured standard and custom casework, with cabinet hardware.

B. Countertops.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements

B. Section 01 8116 - Low-Emitting Materials Restrictions

C. Section 01 8119 - Construction Indoor Air Quality Management

D. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.

E. Section 09 6500 - Resilient Flooring, Base, and Accessories: Resilient wall base.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. 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; 2026.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

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 01 3300 - Submittal Procedure.

B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures

C. Product Data: Component dimensions, configurations, construction details, joint details, and attachments; manufacturer's catalog literature on hardware, accessories, and service fittings, if any.

D. Shop Drawings: Indicate casework types, sizes, locations, using large scale plans, elevations, cross sections. Include rough-in and anchors, placement dimensions and tolerances, clearances required, and keying information.

E. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 2 inches by 3 inches.

F. Samples: Submit two samples of each glazing materials type. Minimum sample size: 2 inches by 3 inches.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Data: Manufacturer's recommendations for care and cleaning.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Spare Parts: Three of each kind of casework hardware.
3. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section during handling and installation, including finished surfaces and hardware items. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Accept casework on site. Inspect on arrival for damage.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:

1. Ruptured, cracked, or stained finish coating.
2. Cracking or peeling of finish.
3. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Casework:

1. Kewaunee Scientific Corp; ____: www.kewaunee.com/#sle.
2. MultiLab LLC; ____: www.multilab.net/#sle.
3. Basis of Design: Mott Manufacturing.

2.02 FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.

1. Style: Flush overlay - square edge.
2. Primary Cabinet Material: Cold-rolled steel.
3. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with the following front-to-back dimensions:
   a. Base Cabinets: 24 inches.
   b. Tall Cabinets: 22 inches.
   c. Wall Cabinets: 14 and 22 inches.
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: 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.
   b. Suspended Units: 300 pounds, minimum, static load.
   c. Drawers: 125 pounds.
   d. Hanging Upper Cases: 300 pounds.
   e. Shelves: 100 pounds.
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, shelves, and drain boards 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. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
13. Access Panels: Where indicated, for maintenance of utility service fixtures and fittings and mechanical and electrical components.
14. Filler Panels: Flanged on both sides, of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

15. Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.

2.03 CABINET HARDWARE

A. Manufacturer's standard types, styles and finishes.

B. Comply with BHMA A156.9 requirements.

1. Acceptable base materials for plated finishes include brass, bronze, and steel.

C. Locks: Provide 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.

D. Shelves in Cabinets:

1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.

E. Swinging Doors: Hinges, pulls, and catches.

1. Hinges: Visible, number as required by referenced standards for width, height, and weight of door.
   a. Visible Hinges: Installed on framed cabinet face, and on door face, satin stainless steel.
2. Pulls: stainless steel wire pulls, 4 inches wide.
3. Catches: Magnetic.

F. Drawers: Pulls and slides.

1. Pulls: stainless steel 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.

2.04 COUNTERTOPS

A. Stainless Steel Countertops: , Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.

1. Finish: 4B satin brushed finish.
2. Construction: Reinforced with 20 gauge paint lock steel hat sections. Underside sound deadened, 1 inch overhang from casework.
3. Exposed Edge Shape: Straight turndown with return; 1-1/4 inch high face, 1/2 inch return to face of case ; reinforced with hardwood or steel.
4. Back and End Splashes: Same material; welded 1/4 inch radius coved joint to countertop; square top edge with 1 inch wide top surface and minimum 1/2 inch turndown.
5. Splash Dimensions: 4 inch high by 1 inch thick, unless otherwise indicated in Drawings.
6. Sinks: Stainless steel, farmhouse style. See Plumbing documents.

2.05 MATERIALS

A. Sheet Steel: High-strength low-alloy, cold rolled and leveled unfinished steel sheet, ASTM A1008/A1008M, Class 1 (matte) finish.

B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, CS or FS Type B, with G90/Z275 coating; stretcher leveled.

C. Stainless Steel Sheet: ASTM A666/A666M Type 304.

2.06 FINISHES

A. Metal (Except Stainless Steel): Degrease and phosphate etch followed by primer; minimum two coats electrostatic enamel; _____ color as selected.

B. Stainless Steel: No. 4 finish.

C. Shop finish all components.

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. Install casework, components and accessories in accordance with manufacturer's instructions.

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.

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 require 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.

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: 1/8 inch in 10 feet .
3. Variation of Faces of Cabinets from a True Plane: 1/8 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. Field touch-up blemishes to original finish.

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, fixtures to function smoothly.

3.04 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean casework, counters, shelves, glass, legs, hardware, fittings and fixtures.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.

C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 12 4813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated aluminum entrance floor mat.

1.02 RELATED REQUIREMENTS

A. Section 01 8113 - Sustainable Design Requirements
B. Section 01 8116 - Low-Emitting Materials Restrictions
C. Section 01 8119 - Construction Indoor Air Quality Management
D. Section 03 3000 - Cast-in-Place Concrete

1.03 SUBMITTALS

A. See Section 01 3300 - Submittal Procedure.
B. See Section 01 8113 - Sustainable Design Requirements for LEED submittal procedures
C. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.
D. Shop Drawings: Indicate dimensions and support locations and mounting..
E. Samples: Submit two samples, 12 by 12 inch in size illustrating pattern, color, finish, and edging.
F. Maintenance Data: Include cleaning instructions, and stain removal procedures.
G. Warranty: Manufacturer's standard two-year warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Floor Mats:
    1. Construction Specialties, Inc: www.c-sgroup.com/#sle.

2.02 FLOOR MAT AND GRID

A. Recessed machined aluminum grille assembly with pattern grid and machined slots providing free area for fall through of dirt and debris.
B. Basis of Design: Construction Specialties, Floormations
    1. Pattern: Crosshatch.
C. Material: Aluminum - ASTM B 209, alloy 5000 series for floor tile fabrication.
    1. Solid 5052-H32 aluminum plate with a minimum thickness of 0.25 inch.
    2. 6105 aluminum supports.
D. Rolling load: 300 pounds per wheel
E. Max deflection: 0.022 inch under 300 psi load.
F. Depth: 3/4 inch.
G. Frame: frameless, for recessed application.
H. Static Coefficient of Friction .5 per ASTM D-2047
I. Accessories: Aluminum supports with 3M Dual Lock.
J. Tread Insert: Carpet Insert- 100% solution dyed Nylon 6 fiber with non-woven synthetic backing, designed for high traffic areas
    1. Color: as selected by Architect from Manufacturer's full range.

2.03 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor opening for mats are ready to receive work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.03 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's recommendations.

B. Set mat at height recommended by manufacturer for most effective cleaning action.

C. Coordinate top of mat surface with bottom of doors that swing across to provide ample clearance between door and mat.

3.04 TOLERANCES

A. Maximum Gap Formed at Recessed from Mat Size: 1/16 inch.

3.05 PROTECTION

A. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recess, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.

B. Defer installation of floor mats until time of substantial completion of project.

END OF SECTION

SECTION 14 21 00 – ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes the following:
   1. Provide where shown, all materials, labor, services, permits and related work, to furnish a complete, operating, tested, functioning, documented traction elevator installation including all work shown, specified or required, including but not limited to the following:
      a. Provide one (1) simplex machine-room-less traction elevator system of capacity and features scheduled and specified.
      b. Provide pit ladders.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Submit product data for each elevator including capacities, sizes, performances, operations, safety features, controls, finishes, and similar information.

C. Submit shop drawings for each elevator showing plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, and relationships with other construction. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and locations of signals. Include maximum and average power demands. Include maximum and average total current harmonic distortion levels (THID).

D. Submit maintenance manuals for each different traction elevator model or type, including operation and maintenance instruction, parts listing with sources indicated, recommended parts inventory listing, emergency instruction, and similar information. Include all diagnostic and repair information available to manufacturers and installer's maintenance personnel. Submit for Owner's information at project closeout as specified in Division 1.

E. Submit inspection and acceptance certificates and operating permits as required by governing authorities for normal, unrestricted elevator use.

F. Submit color and material selection chart for all Architect selected finishes.

G. Submit welding certificates for all individuals performing field welding.

H. Submit warranty information from manufacturer and guarantee from contractor.

1.04 SPECIFICATION INTENT

A. It is the intent of the Specification to provide traction elevators which conform to Cornell University Standards in terms of keying, car accessories and maintainable parts. The standard offering of an elevator vendor shall be considered acceptable so long as the furnished materials meet the University standards for keying and replaceable parts, and the unit can be fully maintained and adjusted by third parties. The above shall be interpreted to include all annual and 5-year inspection tests as required by the AHJ. The vendor shall also agree to provide the sale of replacement and/or spare parts directly to the University's designated maintenance contractor.

B. By submission of this bid, Contractor agrees that any and all equipment, devices, software, etc., shipped from the factory with the elevator, or installed in the field during construction, shall remain on the unit regardless of the execution of a continuing maintenance agreement with the Owner. The Contractor shall not remove any component part, software module, license, etc. from the equipment at the expiration of the warrantee period. Intellectual property of the manufacturer shall remain the ownership of the manufacturer at all times, and the Owner agrees to prohibit release of any such property to third parties without the consent of the manufacturer.

1.05 APPLICABLE CODES

A. Facilities to comply with all current applicable building codes. These codes include but are not limited to:
   1. Americans with Disabilities Act (ADA).
   2. 2020 Building Code of NYS.
   3. NFPA 72 National Fire Alarm Code, 2016 Edition.
   4. ASME A17.1 Safety Code for Elevators and Escalators, 2016 Edition.
   5. NFPA 70 National Electric Code, 2017 Edition.

1.06 DEFINITIONS

A. Traction Elevators: Elevators in which cars are hoisted by the action of a series of ropes, sheaves, and motors, together with other components of the work, including governors, safeties, car enclosures, hoistway entrances, operation systems, signal equipment, guide rails, electrical wiring, buffers, and devices to provide operation, safety, security, and required performance at rated speed and capacity.

B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

C. Authority Having Jurisdiction (AHJ): For this project, the AHJ is the City of Ithaca, Division of Code Enforcement.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Engage the elevator manufacturer or an experienced Installer approved by the elevator manufacturer who has completed elevator installations similar in material, design, and extent to that indicated for this Project and who has a documented record of successful in-service performance.

B. Regulatory Requirements: In addition to local governing regulations, comply with the applicable provisions of the codes and standards listed in Part 1.03.

C. Accessibility Requirements: In addition to local governing regulations, comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."

1.08 WARRANTY

A. General Warranty: The elevator warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Standard Elevator Warranty: Submit a written warranty signed by manufacturer agreeing to repair, restore, or replace defective elevator work within the specified warranty period.

1. Warranty Period: 12 months from date of completion.

1.09 RELATED WORK TO BE PROVIDED BY OTHER SUBCONTRACTORS AS DESIGNATED BY THE CONSTRUCTION MANAGER: (DO NOT INCLUDE IN THE ELEVATOR BID)

A. Other Subcontractor will provide on-site storage area for elevator equipment. The area shall be dry and enclosed within the building. Space will provide rollable access to the elevator hoistway at ground level, adjacent to the hoistway.

B. Other Subcontractor shall provide scaffolding from the base to the top of the hoistway, if necessary, for use by the Construction Manager for the construction of the hoistway closure wall and to be removed prior to equipment installation by the Elevator Contractor.

C. Other Subcontractor shall provide on-site refuse containers for disposal of elevator packing material.

D. Other Subcontractor shall provide cut-outs to accommodate elevator equipment and patching/painting of walls, floors or partitions in the hoistway and machine room.

E. Other Subcontractor shall provide painting of hoistway entrance, frames and areas surrounding frames, where required.

F. Other Subcontractor shall provide a plumb vertical surface for entrances and supports and shall provide finish floor and grout between door frames to sill line.

G. Other Subcontractor shall provide flooring material in elevator car.

H. Other Subcontractor shall provide guarding and protection of the public from the hoistway during construction. Elevator Contractor shall provide barricades for the protection of workers as specified in this Section.

I. Other Subcontractor shall provide elevator pit with sump pump as shown on the plumbing drawings.

J. Other Subcontractor shall provide a rough opening at entrances which is 10″ greater than the entrances.

K. Other Subcontractor shall in-fill to the entrance frames after installation of the frames by Elevator Contractor.

L. Other Subcontractor shall provide a permanent light fixture in each elevator pit together with GFCI outlet and outlet for the sump pump and light switch.

M. Other Subcontractor shall provide enclosed Control Room maintained at a temperature between 32°F and 95°F.

N. Other Subcontractor shall provide a fire extinguisher in Control Room.

O. Other Subcontractor shall provide illumination of the Control Room providing 19 footcandles minimum at the floor level.

P. Other Subcontractor shall provide a self-closing and self-locking door for the Control Room.

Q. Other Subcontractor shall provide ventilation to maintain the temperature at the top of the hoistway below 113°F.

R. Other Subcontractor shall provide a GFCI outlet along with illumination at the top of the hoistway in the vicinity of the hoistway machine. The light switch and outlet to be located in coordination with the Elevator Contractor.

S. Other Subcontractor shall provide fire alarm system interface with suitable relays for Phase 1 Recall and contact for firefighter's hat activation. (Connection to Elevator Controller by Elevator Contractor).

T. Other Subcontractor shall provide shunt trip main circuit breaker at location as shown on the drawings.

U. Other Subcontractor shall provide 208Y/120V, 3-phase circuits for machine power and a separate 120V, 1-phase circuit for car lights. Car light circuits shall be fed from emergency power sources.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering machine-room-less elevators that may be incorporated in the Work include, but are not limited to, the following

1. Approved installation companies:
   a. KONE Inc.
   b. Otis Elevator Company.

B. The basis of design is the Gen3 Edge rail supported product for the simplex elevator, or the equivalent KONE product. Substitutions of a lesser quality or lighter duty use shall not be considered acceptable.

C. Contractors proposing to furnish the products of other vendors shall submit at the time of bid, a letter stating one of the following:

1. By submission of this bid the contractor certifies to the Owner that the contractor has reviewed the proposed elevator product and verified that it will meet the dimensional and performance requirements shown and specified for this project.

OR

2. By submission of this bid the contractor certifies to the Owner that the contractor has reviewed the proposed elevator product and verified that the contractor will be able to adjust the dimensional and building interface features shown and specified to allow installation of the proposed elevator product at no additional cost to the Owner or any other subcontractor or contractor. The Contractor further certifies that the proposed unit will meet the performance requirements shown and specified for this project.

2.02 GENERAL MATERIALS AND COMPONENTS

A. Provide Cornell University standard equipment. Where components are not otherwise indicated, provide only non-proprietary, ASME A17.1 and ADA compliant components as required for a complete system.

2.03 ELEVATOR CAR

A. Provide and install a new ASME A17.1, AHJ approved, ADA compliant elevator car.
   1. Provide a manufacturer's standard interior finish product. Elevators shall have vertically applied vertical textured stainless steel wall panels.
   2. Provide new ASME A17.1 compliant platform of welded steel. Subfloor shall be a minimum of ¾″ marine grade plywood.
   3. Ceiling shall be suspended island design with stainless steel finish.
   4. Lighting shall be recessed LED downlights, ASME A17.1 compliant, any two capable of supplying a minimum of 5 ft/candles to the car floor entrance threshold.

B. Provide and install manufacturer's standard "Luxury" or "Premium" ADA compliant, vandal resistant applied-style Car Operating Panel (C.O.P.) with:
   1. Satin stainless steel finish.
   2. Hands free emergency telephone installed in the C.O.P.
   3. Emergency light.
   4. Keyed off/on switches for inspection, phase two fire service, run/stop, light, fan, hoistway access, and independent service.
      a. Fire Service: # FEO-K1.
      b. Independent, Lights and Fan: Vendor standard keying.
      c. Inspection, Hoistway Access, and Run: Vendor standard keying.
   5. Red illuminated Fire emblem, and hands free phone call received.
   6. Local Alarm button, call cancel, alarm, door open, and door close.
   7. Provide illuminated buttons with Braille tags and audible signal registered display for each floor.
   8. C.O.P. shall be provided with permanently engraved fire service instructions.
   9. C.O.P. shall contain a digital position indicator with voice annunciation and passing chime.

C. Flooring shall be rubber tile RT-1 provided by GC. Elevator Contractor to arrange sill heights to allow this finished material.

D. Provide electric fan operated ventilation, sufficient to provide one (1) air change per minute, approximately 300 cfm. Exhaust ductwork shall be completely concealed and vandal resistant.

E. Provide ASME A17.1 compliant ceiling emergency exit operable only from the outside. Provide and install a local alarm to be activated upon the opening of the exit door.

F. Provide Car Top Inspection station with guarded A19 Type LED light and switch and GFCI outlet.

G. Provide complete top of car handrail system.

H. Provide pad studs and pads. Arrangements that clip to wall panels or hook into vent slots are not acceptable. Pads shall be heavy duty brown canvas, as manufactured by Palmer Pads.

I. Provide closed loop door operator, hangers, clutch and interlocks.

J. Provide 4″ satin stainless steel base with vents and vent guards.

K. Provide flat stock satin stainless steel handrail on all elevators.

L. The elevator number shall be permanently engraved within the C.O.P.

M. Provide Rath Smartview emergency two-way visual communication system in each elevator and integrate with existing Campus installation for monitoring at Cornell Department of Public Safety.

2.04 ENTRANCE FIXTURES

A. Provide and install manufacturer's standard "Luxury" or "Premium" ASME A17.1, AHJ approved, ADA compliant, vandal resistant hall call fixtures at 42″ center line above the finished floor. Primary recall landing shall have permanently engraved fire service instructions within the call station fixture.

B. All fixtures shall be flush-mount, satin stainless steel finish. Jamb-mount fixtures are not acceptable.

C. Fire Service key switch on Primary recall landing only. Verify primary and secondary recall locations with the AHJ. Fixtures shall have illuminated buttons, Braille tags, and audible signal capability.

D. Provide fire pictographs on each landing, engraved on hall call fixtures.

E. Metal plate floor tags with Braille and raised lettering permanently attached to both sides of the doorframe jambs. Tags shall be riveted to the doorframe at 60″ above the finished floor. Tags shall be satin stainless steel.

F. Provide hoistway access key switches within hall call fixtures on terminal landing fixtures only.

G. Each entrance shall have a vandal resistant digital position indicator/directional lantern fixture located in the elevator lobby on every floor; the fixture shall be located directly adjacent to entrance. Fixture shall have one (1) stroke up and two (2) strokes down gong.
H. Provide emergency phone line monitoring buzzer, light and alarm silence keyswitch at primary recall landing only. These functions may be integrated into the hall station or provided as a separate fixture.

2.05 ENTRANCES

A. 1½ hour UL fire rated doors and frames on each landing.
B. Doors shall be satin stainless steel, flush construction.
C. Nickel silver sills shall be provided at each landing.
D. Doorframes shall be stainless steel with satin finish.
E. Provide infrared door edge detector.
F. Provide Tri-lock door key plug #6950 at each entrance.
G. Provide sight guards and door restrictors.

2.06 MECHANICAL

A. Provide and install an elevator controller in Control Rooms as shown on Contract Documents. Controllers installed in hoistways or entrance frames are not acceptable.
   1. Drive type shall be AC variable voltage variable frequency, fully regenerative. The controller shall be factory equipped for emergency power operation as well as card access security.
   2. VFD shall generate no more than 20% total current harmonic distortion back into the electrical system or shall be equipped with a filter to reduce distortion to the 20% total current harmonic distortion level. Provide detailed submittal data.
   3. Capacity shall be as specified in ASME A17.1.
   4. Provide door nudging and pre-opening.
   5. Terminate all required fire alarm connections as directed to provide Phase 1 Recall and Phase 2 Emergency Operation.
   6. Provide manufacturer's standard factory installed remote monitoring communication interface for Owner- supplied ethernet connection.
   7. Provide traction controller enclosure, floor mounted.
   8. Provide connection for phone lines (provided by others) for emergency phones. Phone will dial Cornell Department of Public Safety.
   9. Make provisions to connect light/fan circuits to separate power disconnect left in the vicinity of the controller by a separate subcontractor designated by the Construction Manager and fed with emergency power.
B. Rails, sheaves and beams shall be sized in accordance with ASME A17.1 requirements based on speed and capacity. Systems shall be engineered to match the hoistway and pit conditions.
C. Provide required concrete and masonry insets and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another specification section.
D. Provide approved capacity plates.
E. Safeties shall be Type "B" flexible safeties.
F. Guides shall be the manufacturer's standard roller guides.
G. Provide and install machine room-less AC gearless traction machine.
   1. Locally available voltage is 208Y/120 volt, 3 phase, 60 Hz.
   2. Motor shall be horsepower and voltage scheduled to meet the loading and speed requirements and to match the building voltage available.
   3. Confirm available motor circuit ampacity as shown on the electrical plans and schedules.
H. Provide ropes and wedge sockets. Ropes shall be equalized with rope tensioner. Alternative suspension means are acceptable as long as metallic strength members are provided.
I. Provide interlocks and terminal landing devices for car entrances and counterweights. Pin all switches to rails where rail connections are made.
J. Provide fascias, dust covers, and toe guards.
K. Provide traveling cables, numbers, and type of conductors to suit elevator controller requirements. Provide additional communications- only traveling cable, with CAT5e twisted shielded pairs for use with security camera (provided by Owner). Cable shall also contain standard twisted shielded pairs for emergency phone and in-car card reader. Draka Model 18-020-99 with RJ-45 terminal blocks.
L. Provide pit stop switches. The stop switch shall be pushed to stop, pulled to run, mushroom head style. A toggle switch is not acceptable.
M. All hoistway wiring shall be wholly enclosed in cableways.

2.07 MICROPROCESSOR LOGIC CONTROLLER

A. Function:
   1. The controller shall start and stop the car smoothly and shall cause the cab to make accurate landings under all load conditions.
   2. Components and operating devices shall govern starting, stopping, direction of travel, acceleration, retardation and speed.

B. Type: Microprocessor based self-diagnostic programmable controller with an Erasable Programmable Read Only Memory with provisions for enabling random access memory for such items as timer adjustments and motion control tuning.
   1. The printed circuit boards (modules) shall be of the type that plug into prewired mounting racks. No field wiring or alteration shall be necessary in order to replace defective modules.
   2. Any field wiring changes required during construction shall be required to be made only to the mounting rack connection points and not to the individual module circuitry or components. If it becomes necessary to alter individual modules, they shall be returned to the factory where such design changes may be made so that correct replacements units are available.
   3. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce-through serrated washers shall not be accepted.
   4. Safety and Motion Circuits: Electro-Mechanical pilot type relays. Safety circuits shall be monitored by the microprocessor for redundant protection. All outputs shall be individually fused.
   5. Identify each device and fuse (ampere rating) on panels by name, letter, or standard symbol, in an approved indelible and legible manner. Coordinate identification markings with wiring diagrams. All logic symbols and circuitry designations shall be in accordance with ANSI Standards.

C. Hand-Held Diagnostic Tester: Shall plug into the control processing unit or shall be capable of being cable connected. Testers shall enable operators to monitor logic, timer, and counter values for more productive operation. Tester shall be furnished to Owner at completion of the Project. Integral (LED) diagnostic devices shall be acceptable in lieu of hand-held tester.

D. Fault Protection System:
   1. Protect against the following:
      a. Complete power circuit protects from failure under short circuit.
      b. Surge protection.
      c. Overload.
      d. Low voltage, phase loss, unbalanced voltage.

E. Components and Operating Devices:
   1. Reverse phase relay.
   2. Additional components and devices as required to suit type of operation specified.

F. Operation:
   1. Provide selective-collective automatic operation as defined in ASME A17.1. Provide optional home landing to floor selected by Owner.

2.08 PAINT

A. Rust inhibitive primer and paint shall be used where painted surfaces are specified.

PART 3 - EXECUTION

3.01 DELIVERY OF TOOLS, MATERIALS AND EQUIPMENT

A. The Contractor shall assume responsibility and all costs associated with the delivery and removal of all materials and equipment. The Contractor shall furnish all trucking, rigging, and transportation for all items required to complete the project. In addition, the Contractor shall accept responsibility to protect the grounds, building, and building contents during associated deliveries and removals.

3.02 BARRICADES

A. Solid barricades shall completely enclose entrances to the shaft from the public and shall have a keyed locked entrance on each floor. Each barricade shall completely contain all portions of the project for each individual landing to a height of not less than 8′-0″ or to the ceiling. At no time shall the barricades be removed prior to the installation of fully functional safety interlocks, and installation of walls. At no time shall any entrance be left open to any elevator shaft. The Contractor shall comply with any and all Occupational Safety and Health Standards for general industry (26 CFR 1911) and for the Construction Industry (29 CFR 1926.) Special attention shall be addressed to Sections 1926.502 Personal Fall Arrest Systems and especially 1926.502(d)(ii) regarding work in Elevator Shafts by all persons working inside the guarded areas. The Contractor shall be required to show documentation that each person who has access to the elevator entrances has been trained in the proper use of personal fall protection. The Owner reserves the right to require additional safety precautions at any time. A copy of the “Elevator Industry Field Employee’s Safety Handbook” shall be required on the site at all times and an additional copy shall be provided to Owner’s Risk Management-Safety Department along with a job specific safety program prior to the beginning of any work. Perform work at all times in accordance with the minimum requirements of the “Elevator Industry Field Employee’s Safety Handbook,” published by Elevator World.

3.03 DUST PROTECTION

A. Barricades shall be so constructed as to protect adjacent portions of the building from dust and debris. Barricades shall be arranged to avoid damage to existing building finishes.

3.04 ELEVATOR EQUIPMENT

A. Install equipment in strict accordance with manufacturers printed installation instructions.

B. All discarded materials are the sole responsibility of the Contractors to completely remove from the site at their expense. The Contractor shall be responsible for documenting compliance with Project Construction Waste Diversion Plans.

C. Adjust and balance car float as required to allow smooth ride conditions.
D. Clean and adjust rails at project completion.
E. Provide AHJ inspection and full load test.
F. All components shall be inspected by the Contractor prior to placing them in service. Additional components not included in this specification deemed by the Contractor necessary for inspection shall be standard.

3.05 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of elevator work. Examine hoistways, hoistway openings, pits, and machine rooms, as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.
B. For the record, prepare a written report, endorsed by the installer, listing dimensional discrepancies and conditions detrimental to the performance of elevator work.

3.06 ADDITIONAL REQUIREMENTS

A. Comply with manufacturer's instructions and recommendations.
B. Welded Construction: Where welded construction is used, comply with AWS standards for workmanship and for qualifications of welding operators.
    1. Submit welding certificates of any personnel performing field welding as a shop drawing.
C. Coordination: Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.
D. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.
E. Lubricate operating parts of systems, including ropes, if any, as recommended by manufacturers.
F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until the car is operable in shaft. Reduce clearances to minimum, safe, workable dimensions at each landing.
G. Leveling Tolerance: ¼″ (6 mm), up or down, regardless of load and direction of travel.
H. Set sills flush with finished floor surface at landings. Fill space under sills solidly with non-shrink, nonmetallic grout.
I. Provide minimum run-by and areas of refuge as specified in the latest issue of ASME A17.1.

3.07 TESTING

A. The Contractor shall provide for all testing and inspection services. The Contractor shall provide for a reasonable amount of time to integrate the elevator operations with the work of other trades. The Contractor shall provide a complete functioning elevator, approved by the AHJ, and is required to make any corrections directed by the AHJ to obtain final approval.

3.08 FIELD QUALITY CONTROL

A. Engineer's pre-inspection prior to formal acceptance testing: Prepare for and conduct testing for Engineer's pre-inspection prior to scheduling formal acceptance testing with the AHJ. Conform with Specification Section 14 28 00 - Elevator System Startup & Witnessed Testing. Demonstrate the function of all buildings to elevator interfaces, including sprinkler shunt trip, recall, lighting, ventilation, operation on emergency generator, etc. Do not bring in an Elevator Inspector until the Contractor has demonstrated functionality of the above tests in the presence of the Engineer.
B. Acceptance Testing: Upon nominal completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by the AHJ.
C. Advise Owner, Architect/Engineer, and Authorities Having Jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.09 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at times of failure in operation and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
B. Make a final check of each elevator operation with Owner's personnel present and just prior to date of Substantial Completion. Determine that operating systems and devices are functioning properly.

3.10 PROTECTION

A. Temporary Use: Do not use an elevator for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.
B. Provide final protection and maintain conditions, in a manner acceptable to the Owner that ensure elevators are without damage or deterioration at the time of Substantial Completion.

3.11 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled, competent employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at a rated speed and capacity. Use parts and supplies as used in the manufacture and installation of original equipment.

B. Perform maintenance, including emergency callback service, during normal working hours.
   1. Include 24-hour-per-day, 7-day-per-week emergency callback service.
      a. Response Time: 2 hours or less.

C. Continuing Maintenance Service: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms.

D. Provide full maintenance service by skilled, competent employees of the elevator Installer for elevators used for construction purposes. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at a rated speed and capacity. Use parts and supplies as used in the manufacture and installation of original equipment.

3.12 "AS-BUILT" DRAWINGS

A. The Contractor shall be required to prepare and submit a set of Division 14 "As-Built" Drawings as the portions of work are completed and prior to application for final payment.

B. The "As-Built" Drawings shall include a full set of the 'as bid' or 'conformed' Contract Drawings for Division 14.

C. The submitted Drawings shall be in the form of full size as-bid first plus additional drawings and attachments following. The Drawings shall be clean, original paper copies of the Contract Drawings, marked up in red pencil or pen with the Contractor's markups. For Floor Plans drawn at less than ¼″ scale, the field drawings shall be expanded to ¼″ scale to provide room for mark ups.

D. The Contractor shall maintain a dedicated set of Construction Drawings at a protected location at the job site for the continuous documentation for these as-builts. The Contractor shall record the actual installed locations of equipment, wiring, conduit/pathway, etc. Record any and all variations from the original Construction Drawings in neat, legible, hand drawn lines and text. Attach copies of Contractor's field sketches and note where they pertain.

E. Confirm that all information provided to the Contractor in the Form of Request for Information (RFI) responses, accepted Requests for Proposal (RFPs), Change Orders and Supplemental Instructions (SIs) are properly conveyed on the Drawings. Show the actual changes made, do not just paste a copy of the RFI, RFP, ASI, or CO unless that document includes a full scale drawing which accurately represents the work actually installed.

F. Confirm that the room names and numbers shown on the As-Built's are the actual room numbers and names posted on the rooms at the time of turnover.

G. Confirm that equipment schedules accurately depict any changes made during construction.

H. For work which becomes concealed as part of the project, keep an accurate record and show on "As-Built" Drawings the actual installed location of any concealed work such as conduit, piping, etc. Provide location on Record Drawings for outside services by indicating actual dimensions from fixed reference points which will be available after completion of construction. "Tie" two (2) dimensions from different reference points to confirm locations of concealed work.

I. For projects extending more than three months, provide the original "As-Built" to the Engineer as the work is completed on sections of the project and obtain a receipt from the Engineer. The Contractor shall be responsible for the safe keeping and maintenance of the "As-Built" Drawings throughout construction, and for maintenance of one (1) photocopy at the Contractor's office for a period of not less than three (3) years following final acceptance.

J. Provide the original copies of the "As-Built" Drawings to the Architect or Engineer in accordance with the provisions of the General Conditions and Division 1. Unless reproducible "As-Built" Drawings are required under the General Condition and Division 1, provide the original paper copy of "As-Built" Drawings to the Engineer.

3.13 OPERATION AND MAINTENANCE INFORMATION

A. Submit Operation and Maintenance Manuals per Section 01 33 00 "Submittal Procedures". Submit reviewed manual content formatted and organized as required by this Section.
   1. The Architect/Engineer will comment on whether content of Operation and Maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Initial Manual Submittal: Submit a draft copy of each manual at least 30 days before commencing demonstration and training. Architect/Engineer will comment on whether the general scope and content of manual are acceptable.

C. Final Manual Submittal: Submit each manual in the final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. The Architect will return a copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting Operation and Maintenance documentation.

E. Format of Operation and Maintenance Manuals: Submit manuals in the form of a single composite electronic PDF file.

1. Electronic Files: Use electronic files prepared by the manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size. “Recognize Text” shall be run on all scanned documents to provide a text searchable PDF.

F. Organization and Requirements for Operation and Maintenance Manuals: Unless otherwise indicated, organize each manual into the format as described below, and as indicated in Figure 1: O&M Manual Diagram, in Section 01 78 23.

1. Title Page: Indicate Building Name, Project Title and Project Number.
2. Table of Contents: Hyperlinked bookmarked information with links to each CSI Master Format specification section contained in manual.
3. Contact List: Indicating name and contact information for the following:
   a. Construction Manager or General Contractor.
   b. Subcontractor.
   c. Architect.
   d. Architect’s Subconsultants.
4. Project Warranties: Include the overall project warranty and hyperlinks to any special warranties included in equipment’s specification sections.
5. Operations and Maintenance Information: Operations and Maintenance information for every CSI specification section included in project. Each section shall contain the final submittal that has been updated to include any architectural remarks, any special Contractor or manufacturer warranty associated with the equipment or system, the installation, Operations and Maintenance manuals for each piece of equipment, including any accessory components, all test reports for systems and equipment and parts list for each piece of equipment.
6. Include a typed guarantee from the Contractor with a 1 year guarantee stated as commencing on the date of final acceptance.
7. The Contractor shall include a complete copy of the O&M Manual checklist which follows this section as the last page of the O&M Manual.

O&M Manual Checklist Date_____

(Include a completed copy of this Checklist in O&M Manual when submitted)

Project_____ Trade_____

Project Name_____

Submitted as an electronic file per Section 01 78 23 YES / NO

Composite electronic PDF file YES / NO

Minimum readable text size YES / NO

Title page "Recognize Text" turned on for all scanned documents YES / NO

……

O&M Manual:

Cover Sheet listing:

Building Name

O&M Manual Table of Contents: Hyperlinked book-marked information with links to each CSI Master Format Specification Section in manual
YES / NO

O&M Manual Contact List:

Contractor
Contractor Name _____
Contractor's Address _ _____
Contact person _____
Tel. & Fax #'s _____

Each Major Subcontractor
Contractor Name _____
Contractor's Address _____
Contact person _____
Tel. & Fax #'s _____

Project Manager
Name

Engineer
Name
Company Name _____
Contact person _____

Architect
Name
Company Name _____
Contact person _____

……

O&M Manual - Remaining Pages: Checklist Page 2

O&M Manual Project Guarantee & Warranties:

Typed guarantee from Contractor with 1 year guarantee stated as commencing on the date of final acceptance by the Owner. Date must be identified _____ _____

Hyperlinks to any special warranties included in Equipment Specifications YES / NO

1. Organized by CSI Specification Section number. YES / NO
2. Each CSI Specification Section included. YES / NO
3. Includes final submittal, updated to contain A/E remarks. YES / NO
4. Includes any special Contractor or manufacturer warranty. YES / NO
5. Includes the Installation, Operation and Maintenance (IOM) manuals for each piece of equipment, up to date for the version of equipment supplied. YES / NO
6. Includes IOM data for accessory data. YES / NO
7. Includes test reports for each piece of equipment. YES / NO

Scan of spare parts list. _____
Scan of all test reports (i.e., fire alarm). _____
Scan of all inspections (i.e., plumbing, electrical). _____
Scan of all certification data. _____
Scan of facility lubrication chart. _____
Scan of facility valve chart. _____
Scan copy of complete temperature control and operating instructions. _____
Completed copy of checklist last page of O&M Manual. _____

END OF SECTION

SECTION 14 21 50 - GC/TRADE SUPPORT FOR ELEVATOR INSTALLATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

A. Provide where shown, all materials, labor, services, permits and related work, to provide elevator hoistways, GC support, electrical, mechanical, fire protection and fire alarm support to enable completion of a complete, operating, tested, functioning, documented elevator system including all work shown, specified or required.

B. The Other Contractor shall provide an on-site storage area for elevator equipment. The area shall be dry and enclosed within the building. Space will provide rollable access to the elevator hoistway at ground level, adjacent to the hoistway.

C. If required by the Other Contractor, provide scaffolding from the base to the top of the hoistway to be used by the Other Contractor for the construction of the hoistway, roof and closure walls. The Other Contractor shall remove scaffolding prior to the date of turnover to Elevator Contractor. (Elevator Contractor shall not require scaffolding.)

D. The Other Contractor shall provide on-site refuse containers for disposal of elevator packing material and Elevator Contractor refuse.

E. The Other Contractor shall provide cut-outs to accommodate elevator equipment and patching/painting of walls, floors or partitions in the hoistway and control room.

F. The Other Contractor shall provide painting of areas surrounding entrance frames.

G. The Other Contractor shall provide steel rail bracket supports as shown on the Drawings.

H. The Other Contractor shall provide a plumb vertical surface for entrances and supports and will provide finish floor and grout between door frames to sill line.

I. The Other Contractor shall provide finished flooring material in elevator car.

J. The Other Contractor shall provide guarding and protection of the public and workers from the project site and hoistway during construction. Elevator Contractor shall provide additional barricades for the protection of workers when Elevator Contractor is on site.

K. The Other Contractor shall provide elevator pit with suitable sump pump or drain.

L. The Other Contractor shall provide a rough opening at entrances which are 10″ greater than the entrances.

M. The Other Contractor shall in-fill to the entrance frames after installation of the frames by Elevator Contractor.

N. The Other Contractor shall provide a permanent light fixture in each elevator pit together with GFCI outlet and outlet for the sump pump and appropriate switches.

O. The Other Contractor shall provide permanent light fixtures in each elevator hoistway.

P. The Other Contractor shall provide a permanent light fixture in each elevator overhead, together with GFCI outlet and appropriate switches.

Q. The Other Contractor shall provide enclosed Control Room maintained at a temperature between 55°F and 95°F.

R. The Other Contractor shall provide a fire extinguisher in the Control Room.

S. The Other Contractor shall provide illumination of the Control Room.

T. The Other Contractor shall provide a self-closing and self-locking door for Control Room.

U. The Other Contractor shall provide fire alarm system interface with suitable relays for Phase 1 and Phase 2 recall and contact for fireman's hat.

V. The Other Contractor shall provide fused disconnect switch at location designated by Elevator Contractor with associated wiring for car light/fan circuit.

W. The Other Contractor shall provide shunt trip main circuit breakers at location designated by Elevator Contractor, with associated wiring.

X. The Other Contractor shall provide 208Y/120V, 3-phase circuits for machines and separate 120V, 1-phase circuits for car lights/fans. All circuits shall have full-sized ground conductor.

PART 2 - PRODUCTS

2.01 ELEVATOR CAR FLOORING

A. Provide flooring in elevator car as per Architect.

PART 3 - EXECUTION

3.01 DELIVERY OF TOOLS, MATERIALS AND EQUIPMENT

A. The Contractor shall assume responsibility and all costs associated with the delivery and removal of all materials and equipment. The Contractor shall furnish all trucking, rigging, and transportation for all items required to complete the project. In addition, the Contractor shall accept responsibility to protect the grounds, building, and building contents during associated deliveries and removals.

3.02 BARRICADES

A. Solid barricades shall completely enclose entrances to the shaft from the public and shall have a keyed locked entrance on each floor. Each barricade shall completely contain all portions of the project for each individual landing to a height of not less than 8′-0″ or to the ceiling. At no time shall the barricades be removed prior to the installation of fully functional safety interlocks, and installation of walls. At no time shall any entrance be left open to any elevator shaft. The Contractor shall comply with any and all Occupational Safety and Health Standards for general industry (26 CFR 1911) and for the Construction Industry (29 CFR 1926). Special attention shall be addressed to sections 1926.502 Personal Fall Arrest Systems and especially 1926.502(d)(ii) regarding work in Elevator Shafts by all persons working inside the guarded areas. The Contractor shall be required to show documentation that each person who has access to the elevator entrances has been trained in the proper use of personal fall protection. The Owner reserves the right to require additional safety precautions at any time. A copy of the "Elevator Industry Field Employee's Safety Handbook" shall be required on the site at all times and an additional copy shall be provided to The Syracuse University Risk Management-Safety Department along with a job specific safety program prior to the beginning of any work. Perform work at all times in accordance with the minimum requirements of the "Elevator Industry Field Employee's Safety Handbook," published by Elevator World.

3.03 PROTECTION

A. Temporary Use: Do not use elevator for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

END OF SECTION

SECTION 14 28 00 - ELEVATOR SYSTEM STARTUP & WITNESSED TESTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

A. This Section includes the following:

1. Engineer's pre-inspection elevator testing of building interfaces.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 WITNESSED TESTING

A. At the completion of the elevator installation, prior to calling in for an elevator inspection, the Construction Manager shall review and complete the attached pre-inspection checklist. Once Construction Manager is satisfied that all work is successfully completed, the Construction Manager shall notify the Engineer and Owner that the elevator is complete and shall submit the attached completion certification to the Engineer, suitably signed. The Engineer and Owner shall arrange to be present on site to witness the elevator operation. The following operations shall be verified:

1. Normal operation, including independent service.
2. Card security functionality (if provided).
3. Operation on emergency power, including pre-transfer landing and emergency power indicator light functionality (if provided).
4. Recall and fire service operation, including primary and secondary recall, fire fighters hat functionality.
5. Shunt trip operation (if provided).
6. Emergency phone functionality.
7. Remote elevator control panel functionality (if provided).
8. Emergency two-way visual communication system.

END OF SECTION

Owner

Cornell University
Engineering & Project Management
102 Humphreys Service Building
Ithaca, NY 14853
Phone (607) 327-1709

Engineer

Trivium Engineering P.C.
476 East Brighton Avenue
Syracuse, NY 13210
Phone (315) 476-8311

Pre-Inspection Checklist for New Elevator Installations & Modernizations

Notice: This checklist reflects the most common issues encountered when performing an Engineer's inspection. The Engineer's inspection does not preclude the Contractor from obtaining an AHJ approved elevator inspection. Violations not indicated below may appear during AHJ inspections. It is suggested that elevator industry personnel have access to a current set of applicable code books. The most common industry code books are: The ASME A17.1 Elevator Code 2022 Edition; The 2025 Building Code of New York State; NFPA 13 Sprinkler Code; NFPA 72 Fire Alarm Code; NFPA 70 National Electric Code.

Instructions:
Check each box when the item is completed. Note any variances received from The City of Ithaca or New York State. Submit the completed form to the Engineer prior to scheduling the Engineer's inspection.

-In the Machine Room and/or Control Room

- ❑ All non-elevator-related piping and equipment are prohibited from entering or passing through the machine room per ASME A17.1 section 2.8.1.
- ❑ Electrical disconnects must be lockable in the open position and properly located within sight of the elevator devices as outlined in NFPA 70 section 620.51. All disconnects must be properly fused or utilize a non-self-resetting circuit breaker.
- ❑ A dedicated circuit with lockable fused disconnect is required to be located in the machine room serving the car lighting per NFPA 70 section 620.22.
- ❑ A dedicated circuit shall service machine room lighting and receptacles. Receptacles in the machine room shall have GFCI protection by a GFCI-type receptacle NFPA 70 section 620.6.
- ❑ Warning signs shall be posted when there is power from more than one source per NFPA 70 section 620.52.
- ❑ Electrical clearances are to be provided and maintained in front of the controller and disconnect at all times. It is interpreted that machine room doors that swing into the electrical clearance area endanger worker safety and are prohibited.
- ❑ Machine rooms are to be properly lit, so the electrical control devices and machinery are well illuminated. The light switch is to be located in the machine room and placed near the machine room door jamb per ASME A17.1 section 2.7.9.1. The required lighting shall not be connected to the load side of a GFCI per NFPA 70 section 620.23.
- ❑ All electrical equipment, controllers, and machines are to be properly installed and grounded per NFPA 70 section 620.82. All electrical conduits are to be properly secured and routed in a workmanlike manner.
- ❑ An "ABC" type fire extinguisher is required to be located in the room per ASME A17.1 section 8.6.1.6.5.
- ❑ Holes around piping and structure penetrations in the machine room are to be properly filled and firestopped to maintain a fire rated enclosure.
- ❑ The machine room door is to be self-closing and self-locking per ASME A17.1 section 2.7.3.4.

- ❏ The clear headroom in the machine room shall be not less than 7 feet per ASME A17.1 section 2.7.4.1.
- ❏ Machine rooms are to be vented and/or heated by mechanical or natural means to ensure proper operating temperatures of the equipment at all times per ASME A17. 1 section 2.7.9.2. If the elevator machine room is provided with standby power, the machine room HVAC shall be provided with standby power as well.
- ❏ Where sprinklers are provided in the elevator machine room, they shall be served by a dedicated branch line with non-retardable flow switch and control valve with tamper switch. Alternatively, a preaction sprinkler system may be installed. In either case, sprinkler activation in the machine room shall activate shunt trip operation.
- ❏ The circuit supplying the shunt trip device coil shall be served by emergency power, when available, and shall be monitored for power loss.

-In the Pit Area

- ❏ A pit ladder is required with a handrail at least 48 inches above the landing. The ladder is to be non-combustible and located near the jamb side of the hoistway door, the rungs are to have a clearance of not less than 4½ inches, spaced 12 inches apart and not less than 16 inches wide. See ASME A17.1 section 2.2.4.
- ❏ A pit stop switch is to be located adjacent to the pit ladder and 18 inches above the landing in order to be accessible before stepping onto the pit ladder. A second pit stop switch is required when the pit exceeds 67″ in depth.
- ❏ A light for the pit is to be located so as to provide adequate lighting for the area. The switch is to be near the stop switch. The light is to be guarded. See ASME A17.1 section 2.2.5. The required lighting shall not be connected to the load side of a GFCI per NFPA 70 section 620.24.
- ❏ A dedicated circuit shall service pit lighting and receptacles. A GFCI type receptacle is required in pits per NFPA 70 section 620.6. When a sprinkler is present in the pit area, a weatherproof while-in-use cover is required. A permanently installed sump pump shall require GFCI protection per NFPA 70 section 620.6.
- ❏ Sprinklers are required in the pits of hydraulic elevators and are to be served by a dedicated branch line with flow switch and control valve with tamper switch. See NFPA 13 sections 8.15.5.1 and 8.15.5.2. Activation of sprinkler heads located not more than 24" off the pit floor shall not activate shunt trip operation.

-In the Hoistway

- ❏ All non-elevator-related piping and equipment are prohibited from entering or passing through the hoistway per ASME A17.1 section 2.8.1.
- ❏ All offsets or ledges within the hoistway greater than four inches are to be tapered to not less than 75 degrees per ASME A17.1 section 2.1.6.
- ❏ In general, sprinklers are not required in elevator hoistways and shall be prohibited. Where sprinklers are required, they are to be served by a dedicated branch line with non-retardable flow switch and control valve with tamper switch. Sprinkler activation in the elevator shaft shall activate shunt trip operation.
- ❏ Hoistway ventilation is generally not required; however, if provided it shall be activated by fire alarm initiating devices (smoke detectors/heat detectors) at each lobby. The circuit supplying the hoistway ventilation system (damper, hatch, etc.) shall be served by emergency power, when available, and shall be monitored for power loss unless the system is arranged to fail open upon loss of power.

-General, Operations, and Building Interface

- ❏ A hands-free emergency phone shall be provided in the elevator car and shall ring the Cornell University Department of Public Safety.
- ❏ Fire alarm initiating devices must be properly located in each elevator lobby and in the machine room. Activation of these devices shall initiate primary or alternate recall, as required.
- ❏ Smoke detectors and heat detectors are required in the hoistway when a sprinkler head is located in the hoistway. See ASME A17.1 section 2.27.3.2 & NFPA 72. Fire alarm initiating devices in the machine room or hoistway, if provided, shall initiate primary or alternate recall shall cause the visual signal in the car to illuminate intermittently per ASME A17.1 section 2.27.3.2.
- ❏ Smoke detectors shall not activate shunt trip. Shunt trip shall only be activated by heat detectors or by flow switch on branch lines serving machine room and hoistway (if provided).
- ❏ In general, glass is prohibited in elevator cars and hoistways.
- ❏ If card access security is provided, activation of recall and/or fire service shall bypass all lockouts and restrictions.
- ❏ If elevator machine is provided with standby power, the elevator shall be interlocked with the transfer switch feeding the elevator such that when the elevator is operating on emergency power, an indicator is lit at the primary recall floor. See ASME A17.1 section 2.27.2.3. Additionally, the elevator shall move to the nearest floor and open its doors prior to transfer switch operation.
- ❏ Loss of power to a group of elevators provided with emergency power shall cause sequential recall of elevators. Operation of elevators on emergency power shall be determined by the position of generator selector switch.
- ❏ If provided, remote elevator control panel shall be provided with position indicator, fire service switch, and generator selector switch, if required. Fire service switch at remote elevator control panel shall be On-Off only.
- ❏ Illumination at the landing sill shall be not less than 10 footcandles per ASME A17.1 section 2.11.10.2.

❑ All signage required by NFPA 70 and ASME A17.1 must be properly installed including the following examples: code data plates, fire service instructions, emergency identification numbering, hoistway door floor numbers, rope data tags, in-car capacity tags, crosshead data tags, governor rope data tags, full-load working pressures, and governor tripping speeds.

I certify that the above items have been verified and found to be in proper working order for the following elevator(s).

Elevator(s): _____
Certified by: Print Name: _____ Signature:_____
Company: _____
Date: _____ Phone: _____

Remarks:

_____

_____

_____

_____

_____

BASIC FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final hot water, glycol, chilled, drain, vent**,** connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding.

END OF SECTION

VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES

A. General: Valves shall have the following requirements:

1. Working pressure stamped or cast on bodies.

2. Stem packing serviceable without removing valve from line.

3. UL listed and FM approved and labeled for intended fire protection service. Sprinkler systems 175 WWP;

B. Acceptable Manufacturers:

1. Gate Valves: Kennedy, Mueller, Nibco, Stockham, Victaulic.

2. Butterfly/Ball Valves, Indicating Type: Grinnell, Kennedy, Milwaukee, Stockham, Victaulic.

3. Check Valves: Grinnell, Kennedy, Nibco, , Victaulic.

2.2 GATE VALVES

A. 2-1/2 in. and Larger: IBBM, resilient wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 200 WWP; Stockham Fig. G-610.

B. 2 in. and Smaller: Bronze body and bonnet, OS&Y, threaded ends, solid wedge, 175 WWP; Stockham Fig. B-133.

2.3 BUTTERFLY/BALL VALVE

A. 2-1/2 in. and Larger: Butterfly style, ductile iron body, lug type, aluminum bronze disc, stainless steel trim, EPDM seat, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, 200 WWP; Stockham #LD-72UF.

B. 2-1/2 in. and Larger: Butterfly style, ductile iron body, ductile iron disc coated with EPDM, bubbletight shutoff, suitable for dead end service, gear operator, provision for tamper switch, grooved ends, 300 WWP; Victaulic Series 705W.

C. 2 in. and Smaller: Bronze body, threaded ends; indicating gear operator, provision for tamper switch; Milwaukee "Butterball".

2.4 CHECK VALVES

A. 2-1/2 in. and Larger: Ductile iron body, aluminum bronze or ductile iron disc coated with EPDM, hinged to a removable access cover for inspection and maintenance, stainless steel shaft and spring, grooved ends, 250 WWP; Viking Model G-1 Swing Check Valve.

B. 2 in. and Smaller: Bronze body, swing type, rubber faced, threaded ends; Grinnell #3315.

2.5 MISCELLANEOUS

A. Trim and Test Valves: Ball, plug, angle or globe type; bronze body; threaded ends; UL listed.

1. Ball Valves: Bronze two-piece body, full port, threaded ends, chrome plated ball, blowout proof stem, reinforced TFE seats, 300 psi working pressure, UL listed, FM approved; Nibco Model KT-585-70-UL.

B. Hose Thread Drain Valves:

1. Ball Valve: Bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all shutoff, check, drain and other type valves as required by Code as indicated and as required for proper system maintenance, isolation and safety.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide hose thread drain valves at all low points to enable complete drainage of all portions of the system.

D. Install valves per respective listing/approval.

E. Grooved joints shall be installed in accordance with the manufacturer’s latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer.

Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.

F. Use ball valves for auxiliary drains.

G. Flushing full-port ball valves shall be provided on underground mains (inside the building) and above-ground mains, cross-mains, branch lines and run outs of new sprinkler systems (wet and dry), to facilitate any future periodic internal inspections, obstruction investigations and as-needed flushing work. Valves shall be sized per NFPA 25, in order to obtain the NFPA required minimum velocity of 10 ft/s for any given pipe size. As an alternative to the hydraulic calculation valve sizing method, the following sizing rules can be applied:

1-inch thru 2 1/2 inch pipe: line-size full-port ball valve

3-inch pipe: one (1) 2 1/2-inch ball valve

4-inch pipe: two (2) 2 1/2-inch ball valves

6-inch pipe: three (3) 2 1/2 inch ball valves

8-inch pipe: four (4) 2 1/2 inch ball valve.

END OF SECTION

FIRE PROTECTION IDENTIFICATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATIONS

A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating code number, location and valve function. Submit schedule of pipe, equipment and name identification for review before labeling.

1.4 ACCEPTABLE MANUFACTURERS

A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Emedco, Industrial Safety Supply Co., Inc., Lab Safety Supply, Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 PIPING IDENTIFICATION

A. Identification Types:

1. Snap-on type: Provide manufacturer's standard pre-printed, semi rigid snap-on, color coded pipe markers, complying with ANSI-A13.1.

2. Pressure sensitive type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Fire Protection Water	FIRE PROTECTION WATER
Fire Sprinkler Water	FIRE SPRINKLER WATER

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between fire protection, heating and plumbing services with 1/4 in. letters above the valve number.

2. Equal to Seton Style No. M4507.

B. Provide a sign for each control, sectional and drain valve identifying the portion of the building served in accordance with NFPA 13. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.4 EQUIPMENT IDENTIFICATION

A. General:

1. Provide engraved vinyl nameplates for each major piece of mechanical equipment provided, 2-1/2 in. x 3/4 in. size.

2. Nameplates: Equal to Seton Style No. M4562.

2.5 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.

B. The color for all fire protection valves shall be RED.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide valve tags for all valves provided on project.

B. Provide piping identification with directional flow arrows for all piping on project, maximum every 20'-0" or piping installed through rooms, provide at least one pipe label in each room, for each pipe function.

C. Provide equipment tags for all equipment provided.

END OF SECTION

PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.2 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 weight; black steel pipe; ends chamfered for welding or grooved for grooved mechanical connections.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.

2. Threaded Fittings: Class 125, cast or malleable iron, black , as called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions, and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

a. Couplings: Ductile iron, ASTM A395 and ASTM A536, with painted coating, designed for rolled grooved piping,

b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.

c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.

d. Fittings: Elbows, tees, laterals, reducers, adapters as required shall be ductile iron conforming to ASTM A395 and A536. Fittings shall have grooves designed to accept grooved end couplings of the same manufacturer.

e. Victaulic, rigid system, Style 009 couplings cast with offsetting angle pattern bolt pads to provide system rigidity and support in accordance with ANSI B31.1 and B 31.9. UL listed and FM approved; 300 psi wwp; use a gasket and coupling system similar to Victaulic Flush-Seal for all dry type systems; follow all terms of listings/approvals.

f. Acceptable Manufacturers: Victaulic or approved equal.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
Up to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Adjustable steel clevis type for piping 4 in. and larger.

4. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.

C. Spacing Schedule (Maximum Distance between Hangers (ft.-in.):

NOMINAL PIPE SIZE (IN.)	**3/4**	**1**	**1-1/4**	**1-1/2**	**2**	**2-1/2**	**3**	**3-1/2**	**4**	**5**	**6**	**8**
Steel Pipe	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0	15-0
Copper Tube	8-0	8-0	10-0	10-0	12-0	12-0	12-0	12-0	15-0	15-0	15-0	15-0
Rod Size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2

D. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller, complying with NFPA 13.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements, complying with NFPA 13.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal, complying with NFPA 13 Supports:

1. For all piping larger than 2 in., provide intermediate structural steel members for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For weights under 1,000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.

4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

F. Hangers for fire protection piping as specified and in accordance with NFPA 13. Hangers and building attachments shall be UL listed and FM approved for fire protection service. Adjustable swivel ring type hangers are permitted for 3 in. and smaller piping.

2.4 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas.

B. All bushings and nipples required for instruments and gauges shall be brass.

2.5 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two (2) pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

2.6 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.7 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform to the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.8 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A" - Piping Materials at end of this Section for Fire Protection piping.

B. See Exhibit "B" - Testing at end of this Section for Fire Protection piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in size shall be made with reducing fittings.Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required, to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting systems. Conceal piping unless otherwise called for.

B. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing.

C. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations.

Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers on diesel engine exhaust piping where insulation/supports must pass between pipe and hanger. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor.

3.4 PIPE CONNECTIONS

A. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

B. Grooved Mechanical Joints: Pipes joined with grooved fittings shall be joined by a listed combination of fittings, couplings, gaskets and grooves of a single manufacturer. Lubricate and install gasket and couplings. Follow manufacturer's recommendations. Grooved ends shall be clean and free of indentations, projections and roll marks in the area from pipe end to groove.

3.5 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by qualified welder. Use certified welder where specifically required by code or insurance company. If indicated and permitted for fire protection systems, all provisions for welded pipe shall additionally be in accordance with NFPA Standard 13. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

3.6 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior locations: Firmly pack with fiberglass and caulk.

2. Exterior walls above grade: Use sealing element.

3. Exterior walls below grade and above floors: Use sealing element.

4. Cored holes: Use sealing element.

5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

6. Waterproofed walls/floors: Use waterproof sealing element, device or compound.

3.8 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

A. Fire suppression systems shall be hydrostatically tested at 200 psi for two (2) hours in accordance with NFPA 13.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative and shall be justified by hydraulic calculations. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Sprinkler (wet)	Schedule 40, black steel, 2 in. and smaller	Cast or malleable iron	Threaded
	Schedule 40, black steel 2-1/2 in. and larger	Ductile iron	Roll grooved mechanical type couplings

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Sprinklers	Test hydrostatically at 200 psi for two (2) hours in accordance with NFPA 13.

END OF SECTION

FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

A. Comply with the 2020 Fire Code of New York State, FM Global Data Sheets, Cornell University Cross Connection Control Program Manual, ANSI A-17.1, Safety Code for Elevators and Escalators, and referenced edition of the following National Fire Protection Association (NFPA) Standards:

1. NFPA 13: Standard for the Installation of Sprinkler Systems.

2. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

3. NFPA 72: National Fire Alarm Code.

4. NFPA 241: Standard for Safeguarding Construction, Alteration and Demolition Operations.

B. Follow all requirements, recommendations and appendices to comply with the latest edition of the following publications, codes, standards, and listings/approvals:

1. FM Global (FM) Approval Guide.

2. Underwriters Laboratories, Inc. (UL) Fire Protection Equipment Directory.

3. 2020 Fire Code of New York State.

4. OSHA Rules and Regulations.

5. Requirements of Insurance Underwriter and other Authorities Having Jurisdiction.

C. Equipment, devices, hangers and components shall be UL listed and FM approved and labeled for the intended fire protection service.

D. The fire protection work shall be performed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems.

E. Preparation of working plans, calculations and site observation of systems shall be completed by a NICET Level III technician under the direction of a qualified New York State Registered Professional Engineer.

1.3 SYSTEM DESCRIPTION

A. The fire protection system shall be a wet pipe or pre-action automatic sprinkler system arranged to properly protect spaces as indicated.

B. Refer to drawings.

C. The flow test information above is submitted for information only. This contractor shall arrange for a new flow test on the municipal main prior to performing hydraulic calculations. The more restrictive of these two tests shall be used as the basis of design. Coordinate with CU for latest flow test.

D. Fire department connection(s) shall be provided to allow the servicing fire department to augment the system's normal automatic water supply.

E. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any Authority Having Jurisdiction.

F. Use of room design method will not be permitted. Calculations shall be based upon the specific hazard for the areas being protected. The following minimum requirements shall be provided as actually installed in the protected spaces.

1. Hazard Group HC-1: These areas shall include: Office Areas, Conference Rooms, Corridors, Classrooms.

a. Water density: .10 gpm/sq. ft.

b. Maximum coverage per sprinkler = 225 sq. ft.

c. Hydraulic remote area: 1,500sq. ft.

d. Interior hose demand: 0 gpm.

e. Exterior hose demand: 1

2. Hazard Group HC-2: These areas shall include Lab Spaces, Mechanical Rooms, Utility Rooms.

a. Water density: .20 gpm/sq. ft.

b. Maximum coverage per sprinkler = 130 sq. ft.

c. Hydraulic remote area: 2,500 sq. ft.

d. Interior hose demand: 0 gpm.

e. Exterior hose demand: 250 gpm.

G. Maximum coverage for any sprinkler head shall not exceed NFPA or FM Global requirements or the listing for the sprinklers provided, whichever is more restrictive.

H. A minimum 10 psi safety factor shall be provided between the available municipal water supply curve and the total system demand point. The total system demand point shall be at the municipal water main and include the calculated sprinkler and interior hose stream demands plus the exterior hose stream demand at the residual pressure required for proper system operation.

I. The maximum flow velocity shall not exceed 20 ft. per second in the piping system and 15 ft. per second in mains with paddle type waterflow indicators.

J. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Waterflow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.

K. Provide 3/16 in. x 1 in. cadmium plated carbon steel chains and master keyed all brass case hardened padlocks to lock water supply valves in the proper position.

1.4 SUBMITTALS

A. Product Data:

1. Submit manufacturer's catalog cut, specifications and installation instructions for each item or component of fire protection system. Clearly indicate pertinent information such as, but not limited to:

a. Manufacturer's model number.

b. Materials, size, finish and type of connection.

c. Pressure ratings of components.

d. FM approval/UL listing.

B. Certification: Submit Contractor's NICET certification and number.

C. Samples:

1. If requested, submit sample of sprinklers.

D. Drawings and Calculations:

1. All drawings and calculations shall be signed and sealed by a New York State Registered Professional Engineer.

2. Submit complete NFPA 13/FM Global drawings and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Ithaca Fire Department, Cornell Environmental Health and Safety, Cornell Fire Protection Engineer, and FM Global. Contractor shall not commence with construction until all parties listed above have given their approval.

3. Submit hydraulic calculations for each design density/remote area with items in NFPA 13/FM Global Data Sheets incorporated including sketches to indicate flow quantities, sprinklers operating and direction of flow for pipes in looped and gridded systems.

4. Drawing shall be fabrication drawings provided to indicate actual sprinkler, standpipe and equipment layouts. Drawings shall be 1/4" = 1'-0" scale on reproducible sheets of uniform size. Drawings shall show all data required by NFPA 13/FM Global Data Sheets.

5. Submit drawings in one (1) complete package.

E. Record Drawings and Documents:

1. Submit Record Drawings, hydraulic calculations, test reports, and NFPA Above and Below Ground Material and Test Certificates to the Owner's Representative, Insurance Underwriter and other Authorities Having Jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Mixing of manufacturers or models of the same or similar component will not be acceptable.

2.2 FIRE DEPARTMENT CONNECTION

A. Storz quick connect type with 30 degree elbow, cap, chain and escutcheon labeled "AUTOSPKR".

1. 5 in. Storz x 6 in. NPT.

2. Polished chrome plated escutcheon, inlets, plugs and chains.

3. Design Equipment: Potter-Roemer Fig. No. 5795-01 connection with Fig. No. 5799-01 cap and chain.

B. Acceptable Manufacturers: Croker, Elkhart, Potter-Roemer, Engineer Approved Equal.

2.3 PRESSURE GAUGES

A. Water Pressure Gauge:

1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.

2. 0 to 300 psi range, in 5 psi increments with accuracy to meet ANSI B40.1.

B. Acceptable Manufactures: Reliable; FM approval shall be stamped on all pressure gauges.

2.4 SPRINKLERS AND ACCESSORIES

A. Brass or bronze, 1/2 in. orifice, 1/2 in. NPT. 155°F ordinary temperature classification for light and ordinary hazards. Use 286°F sprinklers in Mechanical, Electrical and Elevator Rooms; in vicinity of heat equipment/sources; and in accordance with NFPA 13.

1. Finished Ceiling Areas: Semi-recessed pendent sprinklers with matching two- piece escutcheon, color as selected by Architect of Record.

2. Unfinished Ceiling Areas: Natural brass/bronze finish pendent or upright sprinklers as required.

B. Sprinkler Types and Design Equipment:

1. Quick Response Pendent and Upright: Viking Microfast® Quick Response Pendent and Upright.

2. Quick Response Horizontal Sidewall: Viking Microfast® Quick Response.

3. Quick Response Extended Coverage Horizontal Sidewall: Viking Microfast® EC/QREC Horizontal Sidewall Sprinkler.

4. Sprinkler K-Factor shall be in accordance with FM Global Data Sheet No. 2-0.

C. Acceptable Manufacturers: Reliable, Victaulic, Viking.

D. Flexible Sprinkler Drops:

1. FM Approved braided Type 304 stainless steel tube with union joints, factory tested to 400 psi and listed for up to three (3) 90° bends including bracket for mounting to ceiling or building structure.

2. Design Equipment: Victaulic "VicFlex".

E. Sprinkler Guards:

1. Steel wire cage with base plate and retaining clamps. Same manufacturer as sprinkler.

2. Design Equipment: Viking Model D-1.

F. Sprinkler Cabinets and Spare Sprinklers:

1. Steel or aluminum construction with shelves and shell holes to accommodate the number of spare sprinklers required by NFPA 13.

2. Bright red finish with hinged front door and label.

3. Sprinkler wrenches compatible for each type used.

4. Spare sprinklers for each system of the type and proportion of those used in each system.

5. Design Equipment: Viking Model FPPI.

G. Acceptable Manufacturers: Viking, Reliable, Victaulic.

2.5 ALARM EQUIPMENT

A. Paddle Waterflow Detectors:

1. Adjustable retard feature, SPDT contacts, 24 volt DC, 250 psi rated.

2. Design Equipment: Potter Electric #VSR-AT.

B. Tamper Switches:

1. Integral with valve or separate device installed on valve to actuate alarm upon valve movement, steel enclosure, SPDT contacts, 24 volt DC, mounting brackets and hardware.

2. Design Equipment: Potter Electric #OSYSU (for OS&Y valves) and #PIVSU-A (for post indicator and butterfly valves).

C. Acceptable Manufacturers: Autocall, Potter Electric, System Sensor.

2.6 FLOOR CONTROL ASSEMBLY

A. Fire Protection control module with test and Drain valve. Integrate with ASR assemble.

1. Design equipment: Victaulic Series UM

2. Acceptable Manufacturers: Victualic or approved equal.

2.7 AUTOMATIC AIR VENTS

A. Automatic air vent with drip pan shall include 1/2 in. NPT isolation valve with forged brass body and stainless steel 20 mesh strainer, adjustable purge valve with hose connection, threaded cap and lanyard and automatic air release valve with conical body, recessed venting valve, single float on rigid shaft and bubble breaker.

Drain piping shall be indirectly connected to the nearest sanitary floor drain.

1. Design Equipment: Potter ECS PAV-W.

2. Acceptable Manufacturers: ECS or approved equal.

2.8 SYSTEM COMPONENT IDENTIFICATION

A. At control, test and drain valves, provide permanently marked identification signs constructed of 18 gauge steel with baked enameled finish.

The signs shall be permanently mounted on the piping or wall at the valve, or on the valve, but shall not be hung on the valve with wires or chains which permits easy removal of the sign. The sign shall clearly indicate the valve's purpose and what portion of the structure it serves. Additional signs, shall be provided at each alarm check and dry pipe valve to clearly indicate hydraulic calculation data.

2.9 ADDITIONAL SPRINKLERS AND SPRINKLER GUARDS

A. Include allowance for providing 12 additional sprinklers with related piping, fittings, hangers and 12 additional sprinkler guards installed at locations where job conditions or equipment selections may be required. Provide a credit for sprinklers and guards not installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.

B. Piping shall not pass directly over electric panelboards, switchboards, motor control centers, and similar electric and telephone equipment. However, protection for these spaces shall be provided.

C. Piping shall be installed concealed above finish ceiling area with sprinklers located in the quarter points of ceiling tiles where ceiling tiles are used.

D. Provide a control valve and readily removable flushing connection consisting of a cap at each end of cross mains and branchline piping.

E. Each sprinkler system shall be provided with an automatic vent valve located near the high point of the system in accordance with NFPA requirements.

F. Provide sprinkler guards for sprinklers in mechanical and storage spaces, less than 8 ft. above finished floor subject to mechanical damage.

G. Pipe ball drip valves at a floor drain or to the exterior. Pipe 2 in. main drains and water motor gong drains to discharge to the exterior at approximately 2 ft. above finished grade.

H. Securely install the spare sprinkler cabinets to the building wall at the main riser.

I. Inspector's test valves system auxiliary drains shall be installed 7 ft. or less above the finished floor.

J. Fire department connections shall be installed 3 ft. above finished grade and electric alarm bell approximately 7 ft. above finished grade (mounted directly above fire department connection).

K. Upright sprinklers directly on branch lines shall be installed with their frame parallel to the piping.

L. Provide sprinkler protection under ductwork, groups of ductwork and other obstructions to water spray and distribution. Use intermediate level sprinklers if subject to waterspray from above.

M. Exposed pipe shall be left clean for painting.

N. Coordinate and activate the systems or portions of the system to operational status as soon as possible.

3.2 PIPING, VALVES AND HANGERS

A. Refer to other applicable sections.

B. All piping shall be installed to permit drainage of the system through a main drain valve. Where a change in piping direction prevents drainage of the system, auxiliary drains shall be provided. The auxiliary drain assembly shall consist of a lockable ball valve, nipple and cap or plug and shall be located 7 ft. or less above the finished floor. Pipe drain to an accessible location.

3.3 TESTS

A. General:

1. Pipe installation shall be inspected by Owner's Representative prior to being covered by building construction or backfill.

2. Give the Owner's Representative advance notice of final tests. Perform tests in a safe manner. Provide written certification that tests have been successfully completed. Use NFPA Above and Below Ground Material and Test Certificate Forms.

3. Correct system leaks prior to final test. Do not utilize water additives, caulking, etc. to correct leaks. Provide appliances, equipment, instruments, devices and personnel.

4. Flushing: Follow Contract Documents and utilize open end pipe sections if possible.

B. Pressure Tests:

1. Hydrostatic Tests: Minimum 200 psi and in accordance with NFPA 13 for two (2) hours.

2. Do not subject existing systems to excess pressures.

C. Alarm Tests:

1. Demonstrate activation of alarms and operational trip test.

3.4 SYSTEM TURNOVER

A. Prior to final acceptance, instruct the Owner's Representative in the proper operation, maintenance, testing, inspection and emergency procedures for all systems furnished, for a period of time as needed. Provide one (1) new original pamphlet of NFPA 25. Indicate in writing to the Owner's Representative the provisions for proper maintenance, testing, and inspection of the systems as required by local fire codes.

END OF SECTION

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final hot water, glycol, chilled, drain, vent**,** connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding.

END OF SECTION

VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

A. Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.

2. Stem packing serviceable without removing valve from line.

3. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

B. Acceptable Manufacturers:

1. Balance Valves: Armstrong and Bell & Gossett

2. Ball Valves: Apollo, Nibco, Watts.

3. Gate and Check Valves: Nibco, Watts.

4. To establish a standard of quality and identify features, certain manufacturer's numbers are given in the following paragraphs.

2.2 DOMESTIC WATER VALVES

A. Gate Valves:

1. 4 in. and Larger, Cold Water Service: Epoxy coated, resilient wedge, OS&Y, flanged ends, 175 wwp, UL/FM; Watts 408 RW.

B. Check Valves:

1. 2 in. and Smaller: Lead-free swing check with silicone bronze body, bonnet and trim, PTFE disc seat and stainless steel seat disc washer, 200 psi working pressure, Nibco T-413-Y-LF (threaded) or Nibco's S-413-Y-LF (solder).

C. Ball Valves:

1. For all water services, ball valves shall be:

a.	Body	Lead Free Bronze
b.	Body Style	Full Port, 2 piece
c.	Connection	Threaded
d.	Trim	316 Stainless Steel Ball and Stem, with stem extension to raise handle out of insulation
e.	Seat	Reinforced Teflon (RTFE), 15% glass filled double seal
f.	Seat Working P/T Rating	300 psig @ 250°F Minimum
g.	Body Working P/T Rating	300 psig @ 300°F Minimum
h.	WOG Rating	300 psig Minimum
i.	Lead free	
j.	Lever Handle	
k.	Design Basis Apollo 77CLF-140, Nibco T-585-66LF, Watts LFB6080-G2-SS	

D. Balance Valves:

1. 2 in. and Smaller: Lead-free, brass body, chrome plated brass ball, glass and carbon filled PTFE seat rings, Viton packing, threaded or solder ends, differential readout ports, calibrated nameplate and memory stop indicator rated for 125 psi; and pre-formed insulation to permit access for balancing and readout; Watt Series LFCSM-61-S.

a. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10
1-1/4 in.	10 - 15

Balance Valve Size	GPM Range
1-1/2 in.	15 - 30
2 in.	30 - 60

E. Pressure Reducing Valves:

1. Direct Operated for Cold Water Service:

a. Bronze body construction, renewable stainless steel seat, reinforced Buna-N diaphragm and valve disc integral strainer, adjustable reduced pressure range, for dead end service.

b. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

2. Direct Operated for Hot Water Service:

a. Water Wash Hoods: Same as cold water except with built-in by-pass option; outlet set at 40 psi, rated at 160°F.

b. Dishwashers: Same as cold water except with low pressure range and built-in by-pass option; outlet set at 22 psi, rated at 200°F.

c. Acceptable Manufacturers: Watts Series #223, Cash, Spence or approved equal.

F. Valves for Gauges and Instruments:

1. Use Ball Valve

G. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened stainless steel ball with hose thread end, cap and chain;

a. Apollo 70LF-140 EHC

b. Nibco T. 585-66-LF-HC

2.3 NON-POTABLE, COMPRESED AIR, VACUUM SYSTEMS VALVES

A. For non-potable and house compressed air, and vacuum, ball valves shall be:

a.	Body	Bronze
b.	Body Style	Full or Standard Port, 2 piece
c.	Connection	Threaded
d.	Trim	316 Stainless Steel Ball and Stem

e.	Seat	PTFE or TFE
f.	Seat Working P/T Rating	300 psig @ 250°F Minimum
g.	SWP Rating	150 psig Minimum
h.	WOG Rating	300 psig Minimum
i.	Lever Handle	
j.	Design Basis Apollo 77LF-140, Nibco T-580-66LF	

3.1 INSTALLATION

A. Provide all shutoff, check, balancing and other type valves as indicated, as required by Code and as required for proper system maintenance, isolation and safety. Provide at major building and systems sections. Provide shutoff valves on all branch lines serving two fixtures or more, at all equipment, fixtures, before and after automatic control valves, and at future connections.

B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.

C. Provide drain valves with hose thread connections on all equipment. Provide hose thread drain valves at all low points to enable complete drainage of all piping systems including, water mains, branches, at base of vertical risers and at strainers.

D. Provide shutoff valve and wye-strainer before all automatic control valves and pressure reducing valves.

E. Inspect valves for proper operation before installation. Install underground valve boxes vertically over each valve. Adjust top of box to proper grade. Immediately backfill with crushed stone and carefully tamp into place. Unless otherwise noted, leave in the open position.

3.2 DOMESTIC WATER SYSTEM

A. The main water service shutoff valve inside the building and valves for a 3 in. and larger water meter assembly shall be OS&Y gate valves in accordance with the local water authority requirements.

B. Install balance valves in each hot water circulation branch and where noted.

END OF SECTION

EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment, and services to perform operations required for the complete installation and related work as required in the Contract Documents.

1.2 SUBMITTALS

A. Not required.

1.3 CODES

A. Comply with local, state, and federal codes, regulations, and laws affecting work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cushion Sand: Clean, coarse, and free of organic matter, conforming to New York State DOT Item No. 703.06.

B. Crushed Stone: Crushed stone, graded, free of organic materials, No. 1 to No. 4 size. Conforming to New York State DOT Item No. 703-0201.

C. Gravel Fill: Well-graded natural inorganic sand and gravel conforming to New York State DOT Item No. 703-0202.

D. Ordinary Fill: Well-graded, natural soil, meeting the following requirements:

1. Free of organic and other compressible materials, debris and frozen materials, and of stones larger than 4 in. maximum dimension.

2. Be of such nature and character that it can be compacted to the specified densities.

3. Free of highly plastic clays, of materials subject to decay, decomposition, or dissolution, and of cinders, ash and other corrosive materials.

4. Maximum dry density of not less than 115 lbs. per cu. ft.

5. Material from excavation on the site may be used as ordinary fill if it meets the above requirements.

PART 3 - EXECUTION

3.1 PREPARATORY WORK, SCHEDULING SHUTDOWNS, AND TEMPORARY WORK

A. Build lines to grade and elevations shown. Provide stakes, grade boards, cleats, nails, and instruments. Locate and stake each new run for its entire length. Verify elevations given. Start excavation at low point. Notify Engineer of elevation discrepancies. Protect marks and stations. Before starting excavation work, coordinate with and furnish schedule of work to Owner's Representative and other trades. Provide and maintain temporary walks and bridges over excavations where underground utility lines, sewers, water lines, etc., cross access roads, walks, and streets. Make necessary arrangement with authorities having jurisdiction.

3.2 PROTECTION

A. Provide bracing, shoring, sheathing and other work for protection of personnel, the contract work, excavations, trees, shrubs, existing structures, and surrounding properties. Provide and maintain barricades, warning signs, flags, and lights for the protection of work, workmen, public, and property. Plank walks, pavements, and curbs to be crossed by equipment. Protect adjacent property, fences, trees, shrubs, roads, curbs, sidewalks, manholes, hydrants, and other items.

1. Restore, repair or replace any items damaged or destroyed to a condition equal to that existing before such damage occurred.

B. The use of equipment with metal tracks over paved areas is not permitted unless the pavement is protected with methods as approved by the Owner's Representative.

3.3 INVESTIGATION AND PROTECTION OF EXISTING UTILITIES

A. Every attempt has been made to indicate existing utilities as accurately as possible from existing drawings, surveys, and data. Immediately report other utility lines encountered, but not shown on the drawings. Notify Underground Facilities Protection Organization (UFPO) before starting work. Phone (800)-962-7962 for information and location of nearest organization address and telephone number. Verify exact location of existing utility lines where work crosses existing utilities and where connections are to be made by test hole before starting work. Notify utility companies, municipalities, and other involved jurisdictions when excavating occurs within vicinity of existing underground service such as sewers, water, electric, gas, telephone, including such services owned by Owner. If existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during this excavation, they shall be protected from damage, and securely supported as directed and approved by the involved jurisdiction. Comply with all local, state and federal regulations when working in vicinity of combustible gas piping. Immediately report damage to utility lines to Owner's Representative and involved jurisdiction. Repair or replace utility lines damaged or destroyed as directed and approved by the involved jurisdiction. Excavate by hand in proximity to existing underground utility lines; take extreme care when excavating around ductbanks carrying energized cable. Remove, plug or cap inactive or abandoned utilities encountered during construction operations. The location of such utilities shall be noted on the record drawings. Verify inactivity of services with involved jurisdiction before start of work.

B. Saw cut floor slabs perpendicular to surface and parallel with/perpendicular to walls. Replace slabs and adjacent surfaces damaged by excavation operations with materials equal to adjacent existing materials.

3.4 CUTTING AND PATCHING

A. Prior to starting work, obtain necessary permits and pay all costs and fees. Cut paved areas, perpendicular to surface and in straight saw-cut lines. Replace pavements, roadways, streets, blacktop areas and walks damaged by excavating operations with materials equal to adjacent pavements.

3.5 EXCAVATION

A. Provide for buried work in contract both inside and outside of building. Excavate to proper depth and width for installation work and comply with rules set forth by New York State Department of Labor. Remove materials including masonry work, rubble, earth, brickwork, concrete, sand, debris, abandoned pipe lines, drains, sewers, rocks, boulders, and concrete, all of which is considered "earth excavation". Provide for legal disposition of excess excavated materials. Make allowance for gravel fill, sand bases, form work, floor slabs, manholes, anchor and thrust blocks, sheet piling, drainage pumps, and work space. Start excavation at rough grade and provide form work and sheet piling where required.

B. Trench Excavation:

1. By open cut, to proper depth and grade no wider than required for placement of work and not more than 100 ft. in advance of utility being installed.

2. Should trench bottom be wet, unstable or otherwise incapable of supporting the contract work, immediately report the condition to the Owner's Representative. Should it be deemed unsuitable, excavate to depth as directed and backfill with gravel to trench depth, or provide concrete cradling.

3. Should rock be encountered, excavate 6 in. deeper and fill space between trench bottom and pipe with coarse sand, well compacted to form a firm pipe bed.

C. Shoring, Bracing, Sheathing:

1. In addition to governing codes, protect sides of excavations with shoring, bracing and sheathing to prevent sliding or caving of banks and to protect adjacent structures. Remove as backfill is placed.

2. Provide at locations adjacent to existing manholes, hydrants, and similar items.

D. General Excavation:

1. As required for all buried work. This shall include, but not be limited to, piping, tanks, ductbanks, conduits, footings, manholes, anchors, concrete pads, thrust blocks, fixture bases, and other work in contract.

3.6 BACKFILL

A. Bedding:

1. Around piping with cushion sand from 6 in. below to 8 in. above. Apply by hand and compact under and at sides by mechanical means.

2. Piping, jackets and sand bed must be inspected and tested prior to backfill of any nature. Provide necessary anchors, thrust blocks, for testing.

B. Remainder of Trench:

1. Backfill remainder of trench in 12 in. layers, with ordinary fill materials, except as otherwise specified. Do not use frozen material. Remove boulders, stones, broken rock, wood, bricks, blocks, and debris from fill materials before backfill operation.

C. Compaction Requirements:

1. Compaction to not less than 95% density compared to maximum laboratory tests by weight, per modified ASTM D1557-64T, latest editions, Method "A" under slab on grade, roadways, drives, and other paved areas and 85% for general grading. Submit certified test results by an approved soil testing laboratory.

3.7 REMOVAL OF WATER

A. Provide pumps, hoses, pipe, labor and fuel, necessary to keep excavations free of water accumulation. Maintain and operate equipment. Discharge water in manner not to interfere with any trade's work, undermine or disturb adjacent structures or properties. Grade to prevent surface water from flowing into all excavations and trenches. Do not discharge dirt, backfill or debris into sanitary or storm drainage systems.

3.8 ROUGH GRADING

A. Trim and grade areas to receive fill material or topsoil specified.

B. Set grade stakes where spot elevations are shown, at breaks in grade, along drainage "swales" and as otherwise required to correctly grade the area to existing conditions.

C. On completion of rough grading, obtain Owner's Representative's approval before spreading topsoil or preparing pavement subgrade.

D. Compact fill as specified.

3.9 REPAVING

A. Replace pavement and subbase materials for roads, streets, parking areas, walks, and other surfaces that were damaged or removed during construction. Use details shown on drawings and follow the New York State Department of Transportation item numbers given for base, binder and top courses of bituminous pavement.

3.10 RESTORATION

A. On completion of the work, clean the entire site, remove surplus earth, large stones and debris and legally dispose to an off-site location. Remove tools and equipment and leave the entire area in a neat condition.

END OF SECTION

ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide information in report form listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.

B. Report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

1.3 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Individual manufacturer requirements and recommendations.

B. Maintain qualified person at project for system operation, trouble shooting and perform mechanical adjustments in conjunction with balancing procedure.

C. Balancing contractor shall be current member of AABC or NEBB.

1.4 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balancing facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.

2. Prior to balancing adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required. Instruments used shall be accurately calibrated as per AABC or NEBB requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine Bid Documents and notify Owner's Representative of any questions regarding balancing, within thirty (30) days after receipt of bid and prior to starting work.

3.2 WATER SIDE

A. Test, adjust and record the following:

1. Hot Water Recirculating Pump:

    a. Check rotation
    b. GPM
    c. Running suction pressure
    d. Running discharge pressure
    e. Running load amps
    f. RPM - motor
    g. Complete nameplate motor and pump

2. Recirculation Balancing Valves:

    a. Balance every valve to 1.0 GPM, unless otherwise noted.

END OF SECTION

INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

A. Shall include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.

2. Insulation, including jackets, finishes and adhesives on the exterior surfaces of pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

3. Asbestos or asbestos bearing materials are prohibited.

4. 2020 Energy Conservation Code of New York State.

5. All adhesives and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ E4.1 and EQ E4.2.

6. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.

7. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.2 ACCEPTABLE MANUFACTURERS

A. Fiberglass: Knauf, Johns Manville, Owen-Corning, Certainteed

B. Adhesives: Childers Products, Foster.

2.3 PIPE INSULATION (RIGID FIBERGLASS TYPE)

A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F.

C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system shall consist of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures shall be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.4 FIRE RATED INSULATION

A. Wrap shall be fully tested against external fires (ASTM E 119/UL263), through penetration insulated piping fires (ASTM 814/UL1479), wall fires (ASTM E 119), and surface burning (ASTM E 84/UL723). Wrap for engine exhaust applications shall use two layers of 1-1/2 in. wrap. The interior layer shall be applied with a butt joint. The second layer shall be offset a minimum of six inches from the initial layer, with an overlap of three inches and the insulated pipe is banded with stainless steel straps.

B. Acceptable Manufacturers: John Mansville Firetemp Wrap, Certainteed FlameChek or approved equal.

2.5 FIELD-APPLIED JACKETS

A. Piping:

1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; 25 or less flame spread rating/50 or less smoke developed rating, roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.

2.6 COATINGS, MASTICS, ADHESIVES AND SEALANTS

A. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.

B. Foster 95-50; Childers CP-76, or approved equal.

2.7 PIPE SUPPORT INSULATION INSERTS

A. 20 lbs./cu. ft. molded fiberglass, for -120°F to +450°F service temperature, non-combustible, 0.30 thermal conductivity (k), same thickness as pipe insulation.

B. Acceptable Manufacturers: Hamfab "H" Block, or approved equal.

2.8 MATERIALS AND SCHEDULES

A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.

C. All pipe insulation shall be continuous through hangers, sleeves, walls, ceiling, floor, or roof openings, unless not allowed by fire stop system. Refer to Sections 220500, "Basic Plumbing Requirements" and 221010, "Piping Systems and Accessories" for firestop systems.

D. Provide thermal insulation on clean, dry surfaces and after piping and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, drain valves, etc. must be totally encapsulated with Elastomeric insulation.

F. Items such as manholes, handholds, clean-outs, plugged connections, pet cocks, air vents, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personal injury.

H. All pipes shall be individually insulated.

I. If any insulation material becomes wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

J. All exposed surfaces shall be white, unless noted otherwise.

3.2 PIPE INSULATION

A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed.

B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed. Insulation shall be continuous through hangers on all water piping and storm water piping.

C. Hanger Shields: Refer to Section 221010 "Piping Systems and Accessories".

D. Hanger shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.

1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.

2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.

3. Tape shields to insulation.

E. Joints in section pipe covering made as follows:

1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.

2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.

3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating.

F. Fittings, Valves and Flanges:

1. Domestic Hot and Cold Water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation.

2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.

G. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

H. Apply PVC jacketing to exposed insulated pipe, valves, fittings, and specialties, at an elevation of 8 feet or less above finished floor in mechanical/electrical rooms, penthouses, and services aisles/pipe chases.

I. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness called for. Piping in wall chases: In addition to the above, pack chase with loose glass fiber insulation.

J. Provide insulation on exposed hot and cold plumbing piping to within 18 in. of fixture or equipment connection.

K. Insulate exposed domestic water and waste piping for plumbing fixtures designated for use by the handicapped.

EXHIBIT "I" - PIPE INSULATION MATERIALS
(Notes at end of Exhibit "I")

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Domestic cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTES 1
Domestic hot, tempered and circulation water (105°F - 140°F)	Glass fiber	1-1/2 in. and larger: 1-1/2 in. 1-1/4 in. and smaller: 1 in.	SEE NOTES 1
Domestic hot, tempered and circulation water (141°F - 200°F)	Glass fiber	1-1/2 in. and larger: 2 in. 1-1/4 in. and smaller: 1-1/2 in.	SEE NOTES 1
AC unit drains, overflows and indirect waste piping associated with any HVAC equipment	Glass fiber	All sizes: 1 in.	Not required for exposed PVC drains
Storm and secondary storm water	Glass fiber	All sizes: 1 in.	Insulate body of drain and storm water piping, horizontal and vertical, down to connection below ground floor slab or in crawl space

NOTES FOR EXHIBIT I:

NOTE 1: Exposed insulation at kitchen, laundry, and sterilizer equipment shall be covered with PVC jacket.

END OF SECTION

SECTION 220800

COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. The OPR and BOD documentation are included by reference for information only.

C. Division 01 section 'LEED Requirements' for additional LEED requirements.

1.2 SUMMARY

A. This section includes commissioning process requirements for Plumbing systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

A. Refer to Division 01 Section "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.

B. Refer to Division 01 Section "Submittals" for specific requirements. In addition, provide the following:

C. Certificates of readiness

D. Certificates of completion of installation, prestart, and startup activities.

E. O&M manuals

F. Test reports

1.6 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.

1.7 COORDINATION

A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - 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 plumbing contractor of Division 22 shall ultimately be responsible for all standard testing equipment for the plumbing system in Division 22, except for equipment specific to and used by 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 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.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems

B. 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 made available to the Commissioning Team for use prior to the start of 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.

C. 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 mad by the contractor.

D. 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 four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meetings.

C. Attend domestic water balancing review and coordination meetings.

D. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

G. Prepare preliminary schedule for Plumbing system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.

H. Update schedule as required throughout the construction period.

I. Assist the CxA in all verification and functional performance tests.

J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

K. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.

L. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

M. Notify the CxA a minimum of two weeks in advance of the time for start of the balancing work. Attend the initial balancing meeting for review of the balancing procedures.

N. Participate in, and schedule vendors and contractors to participate in the training sessions.

O. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
   1. Plumbing equipment including domestic water heaters, pumps, plumbing fixtures, and all other equipment furnished under this Division.
   2. Gas piping, sanitary waste and vent piping, storm drainage piping, sump pumps and automatic sprinkler system.
   3. Fire stopping in fire rated construction, including caulking, gasketing and sealing of smoke barriers.

P. The equipment supplier shall document the performance of his equipment.

Q. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.

R. Balance Contractor
   1. Attend initial commissioning coordination meeting scheduled by the CxA.
   2. Submit the site specific balancing plan to the CxA and Design Professional for review and acceptance.
   3. Attend the balancing review meeting scheduled by the CxA. Be prepared to discuss the procedures that shall be followed in balancing the Plumbing system.
   4. At the completion of the balancing work, and the submittal of the final balancing report, notify the Plumbing contractor and the CM/GC.
   5. At the completion of balancing work, and the submittal of the final balancing report, notify the Plumbing Contractor and the CM/GC.
   6. Participate in verification of the balancing report, which will consist of repeating measurements contained in the balancing reports. Assist in diagnostic purposes when directed.

S. Equipment Suppliers
   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 contractors.
   3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

T. Refer to Division 01 Section “General Commissioning Requirements” for additional contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for Owner's Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for Design Professional's Responsibilities.

3.5 CxA'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.6 TESTING PREPARATION

A. Certify in writing to the CxA that Plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that Plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.7 DOMESTIC WATER BALANCING VERIFICATION

A. Prior to performance of Domestic Water Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of Plumbing systems at the direction of the CxA.

1. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
2. The balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final balancing report.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.8 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Plumbing testing shall include entire Plumbing installation. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the Plumbing contractor, balancing subcontractor shall prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.9 PLUMBING SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 22 sections. Provide submittals, test data, inspector record, and certifications to the CxA.

B. Plumbing Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 22 piping Sections. Plumbing Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Plumbing Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, fuel gas, sanitary waste and vent piping, storm drainage piping, sprinkler and domestic water distribution systems.

E. Vibration and Sound Tests**:** Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

F. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

1. Domestic Hot Water System
2. Domestic Water Pumps
3. Domestic Water Heater
4. Air Compressor

3.10 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.11 APPROVAL

A. Refer to Division 01 Section “General Commissioning Requirements” for approval procedures.

3.12 DEFERRED TESTING

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.13 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.

B. Refer to Division 01 Section “General Commissioning Requirements” for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.14 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to training.

END OF SECTION 220800

PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All items here-in used to convey water for potable use shall be lead free in accordance with NSF, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

C. All adhesives, sealers and primers used for piping in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ4.1 and EQ4.2.

2.2 COPPER TUBE AND FITTINGS

A. Pipe: ASTM B88; Type L, hard temper. Soft temper only as called for. Plans show copper tube sizes.

B. Fittings: Wrought copper and copper alloy, ASME B16.22, ASME B16.18; solder end connections.

C. Joints: Comply with the requirements of ASTM B828.

D. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

E. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

F. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.

G. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.3 COPPER DRAINAGE TUBE AND FITTINGS

A. Pipe: ASTM B306, Type DWV, hard temper.

1. Copper not allowed for urinal waste.

B. Fittings: Wrought copper, ANSI B16.29; solder end connections.

C. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.

D. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.

E. Acceptable Manufacturers: Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe", or approved equal.

2.4 NO-HUB CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A888, CISPI Standard 301, no-hub cast iron, bitumen coated.

1. For above grade only.

B. Fittings: Cast iron, no-hub drainage pattern, bitumen coated.

C. Couplings:

1. 1-1/2 in. to 2 in.: CISPI standard 310 with 300 series stainless steel corrugated shield and clamp assembly with ASTM C564 neoprene sealing sleeve (or) same as specified for 3 in. and larger.

2. 3 in. and Larger: 24 gauge, Type 304 stainless steel housing clamp assembly with ASTM C564 neoprene sealing sleeve, 60 in. lbs. minimum torque rating, shall meet requirements of pipe manufacturer and shall be compatible with specified pipe. Acceptable Manufacturers: Clamp-All Coupling System, Tyler "Wide Body", Husky "Series 2000", Mission "Heavy Weight" or approved equal.

D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.5 SPECIAL FITTINGS

A. Cast Iron to Lead Pipe: Red brass ferrules and wiped joints. Caulk ferrule into cast iron hub.

B. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.

C. Copper to Steel Piping:

1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.

2. Dielectric pipefittings.

D. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).

E. No-Hub, Cast Iron, Glass, Polypropylene or High Silicon Cast Iron: Proper adapter to piping being connected.

F. Cast Iron and PVC Solvent: Aerators and deaerators as manufactured by Conine Manufacturing Co., Inc.

2.6 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Nipples: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded ends, insulating material suitable for system fluid, pressure and temperature.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Watts or approved equal.

E. Dielectric unions are not acceptable.

2.7 HANGERS, INSERTS AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Adjustable steel clevis type for piping 4 in. and larger.

4. Nuts, washers and rods with electroplated zinc or cadmium finish.

5. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.

C. Spacing Schedule:

Pipe Size	Steel	Copper	Plastic	Cast Iron	Rod Size
3/4 in. to 1 in.	8 ft.	6 ft.	3 ft.	Each	3/8 in.
1-1/4 in. to 2 in.	10 ft.	6 ft.	3 ft.	Horizontal	3/8 in.
2-1/2 in. to 4 in.	12 ft.	10 ft.	4 ft.	Joint 5 ft.	1/2 in.
5 in. and over	12 ft.	10 ft.	4 ft.	Maximum	5/8 in.
8 in.	12 ft.	10 ft.	4 ft.	O.C.	3/4 in.
Over 8 in.	To suit loading conditions.				

D. Cast Iron No-Hub Supports:

1. In accordance with manufacturer's recommendations.

2. Vertical piping supported at each stack base, at each floor and 15 ft. on center, maximum. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment. Bases of stacks shall be supported on concrete, brick laid in cement mortar, metal brackets attached to the building construction or by other methods approved by the Owner's Representative.

3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.

E. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.

2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

F. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.

4. For Wood Construction: Provide hangers and supports designed for attachment to wood construction.

5. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

H. Trapeze Hangers:

1. For plumbing systems only.

2. Hangers shall be supported with rod sized with a safety factor of four.

3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.

4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.

5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.

I. Cabinet Pipe Space Supports:

1. Piping below casework countertops within space behind cabinet shall be supported using continuous slot metal channels with pipe clamps.

2. Acceptable Manufacturers: B-Line, Kindorf, Unistrut or approved equal.

J. Hanger Insulation Shields:

1. Hanger insulation shields shall be provided for all water and storm water piping. Hangers shall attach directly to pipe for all remaining services.

2. Piping 2 in. and Smaller: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation.

3. Piping 3 in. and Larger: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield and pipe support insulation insert(s) between pipe and hanger.

Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation. Provide temporary blocking to maintain proper spacing for insulation.

K. Piping systems with material not listed above shall be supported and protected in accordance with manufacturer's recommendations.

2.8 PIPING ACCESSORIES

A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.

B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.

2.9 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

2.10 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.11 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.12 STACK SLEEVE

A. Cast iron body with caulking recess, flashing clamp and under deck clamp.

B. Acceptable Manufacturers: Jay R. Smith Series 1720, Zurn, Wade.

2.13 STRAINERS

A. Description: Y-Pattern, self-cleaning, except where otherwise indicated, full size of connecting piping, Type 304 stainless steel screens, 125 lb. SWP, unless otherwise indicated.

B. Copper Piping 2-1/2 in. and Smaller: Lead free, cast bronze body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #LF777S.

C. Piping 3 in. and Larger, Cold Water Applications: Lead free, cast iron body, flanged ends, standard screen openings, FDA approved epoxy coating, tapped retainer cap and gasket with closure plug; Watts #77F-DI-FDA-125.

2.14 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.

B. See Exhibit "B", "Testing" at end of this Section.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110.

Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger that 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.

B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.4 PIPE CONNECTIONS

A. No-Lead Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.

C. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.

D. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Dielectric Pipe Fittings: Provide dielectric nipples at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined.

1. Dielectric Unions are not be to used.

3.5 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.

B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.

C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.

D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.

E. Fill abandoned sleeves with concrete.

F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.6 SLEEVE PACKING

A. Seal void space at sleeves as follows:

1. Interior Locations: Firmly pack with fiberglass and caulk.

2. Exterior Walls and Below Grade Cored Holes: Use sealing element.

3. Cored Holes: Use sealing element.

4. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

5. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

3.7 ESCUTCHEON PLATES

A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.8 TESTS

A. Refer to Exhibit "B" at the end of this section for testing of Plumbing Systems.

B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

C. Domestic Water:

1. Do not cover joints with insulation until required tests are completed and the Owner's Representative accepts the system.

2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.

3. Air test not acceptable as final test.

4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

D. Sanitary and Storm:

1. There shall be no loss of water when testing interior piping.

2. Air test not acceptable as final test.

3. Should any leaks, defective joints or defective construction be detected in sewers and/or floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.

4. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

3.9 DOMESTIC WATER PIPING CLEANING AND DISINFECTION

A. Cleaning and disinfecting shall be in accordance with requirements of New York State Department of Health and authority having jurisdiction. Prior to disinfecting, flush piping to remove any sediment and debris.

B. Clean and disinfect water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired.

C. After disinfection procedures, submit water samples in sterile bottles to an approved Department of Health Laboratory. Samples shall be proven equal to the water quality served to the public from the existing water supply system and acceptable to the Department of Health. Flush and disinfect all sections of pipe that fail the laboratory tests. Submit test results indicating water is potable.

3.10 CONNECTIONS TO SPECIAL EQUIPMENT

A. Laboratory or Other Equipment:

3.11 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Water and Fire service	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Domestic water interior/hot, cold and circulating 3 in. and smaller	Type L copper	Wrought copper	No-lead solder
Sanitary, sanitary vent, grease waste and storm (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sanitary, sanitary vent and grease waste	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Type DWV copper	Wrought copper	No-lead solder (SEE NOTE 3)
Storm	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Type DWV copper	Wrought copper	No-lead solder
Indirect waste 1" and Smaller	Type M copper	Wrought copper	No-lead solder
Indirect waste 1 ¼" and larger	Type DWV copper	Wrought copper	No-lead solder
Compressed air-house	Type L copper	Wrought copper	Brazed
	ASTM B88	ASME B16.22	

NOTES FOR EXHIBIT A:

NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code. Pipe and fittings shall be flanged.

NOTE 2: Provide one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel on exposed exterior and interior piping. Color as selected.

NOTE 3: Copper piping shall not be used for urinal waste piping.

NOTE 4: All uninsulated piping supported by trapeze hangers shall be securely fastened to each hanger using strut-mounted cushion clamps.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Domestic water	Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.
Indirect waste	Maintain 10 ft. head of water for two (2) hours.
Pump discharge	Hydrostatically test at 5 PSI greater than the pump rating for two (2) hours.
Compressed air	Test with clean air or nitrogen at a pressure of 175 PSI for 24 hours.

END OF SECTION

UNDERGROUND PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents

1.2 SUBMITTALS

A. Provide a schedule of pipe materials, fittings and connections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings new and marked with manufacturer's name, complying with applicable ASTM and ANSI Standards.

2.2 CAST IRON SOIL PIPE AND FITTINGS

A. Pipe: ASTM A74 service weight cast iron, bitumen coated, hub and spigot.

B. Fittings: Service weight cast iron, bitumen coated, hub and spigot, ASTM C564 service weight neoprene gasket of same manufacturer as piping.

C. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.3 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.

B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.4 DETECTABLE TAPE

A. Detectable underground warning tape, 5 mil. polyethylene, 6 in. wide, aluminum backing, APWA approved background colors within permanent black lettering identifying service below.

B. Schedule:

1. Sanitary: Green color, "Caution Buried Sewer Line Below".

2. Storm: Green color, "Caution Buried Sewer Line Below".

3. Water: Blue color, "Caution Buried Water Line Below".

4. Electric: Red color, "Caution Buried Electric Line Below".

C. Acceptable Manufacturers: Seton, Terra Tape, Pro-Line Safety Products, Inc.

2.5 SCHEDULE OF PIPING MATERIALS

A. See Exhibit "A", Schedule of Piping Materials at end of this section for piping.

PART 3 - EXECUTION

3.1 TESTING

A. Sanitary and Storm:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.

2. There shall be no loss of water when testing interior piping inside the building foundation.

3. Air test not acceptable as final test.

4. Should any leaks, defective joints or defective construction be detected in sewers, floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fittings or accessories be discovered they shall be removed and replaced at the Contractor's expense.

5. Test exterior piping outside the building foundation in 100 ft. sections. The allowable rate of leakage per 24 hours per in. of diameter per 1,000 ft. of sewer tested shall not exceed 25 gallons. Piping shall be inspected and tested prior to backfill.

6. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test reports to Owner's Representative.

3.2 DETECTABLE TAPE

A. Provide detectable tape directly over the buried pipe lines at a depth of 1 ft. - 0 in. below finished grade. Install tape over the continuous length of the pipe.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes are at end of Exhibit "A")

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Sanitary and Vent	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 2)

NOTES FOR EXHIBIT A:

NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code. Pipe and fittings shall be flanged.

NOTE 2: Schedule 40 PVC pipe may not be used when the temperature of the waste can exceed 140°F.

EXHIBIT "B" - TESTING

SERVICE	TEST REQUIREMENTS
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.

END OF SECTION

PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards and listings/approvals:

1. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.3 SUBMITTALS

A. Submit manufacturer's data in accordance with the Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 of this Section.

PART 2 - PRODUCTS

2.1 HOT WATER CIRCULATING PUMP

A. Pump: Inline centrifugal, canned rotor type, all stainless steel, system fluid lubricated, 175 psi working pressure, 230°F water temperature, stainless steel shaft, flange mount.

B. Motor: High efficient 4 pole synchronous, permanent magnet motor, EDPM o-ring seals to isolate stator from system fluid, non-overloading throughout the pump curve.

C. Electric Control: Pump motor shall have 3 modes: proportional pressure, constant pressure, constant curve/constant speed control. Refer to schedule on drawings for capacity and electrical characteristics.

D. Acceptable Manufacturers: Armstrong, Bell and Gossett, Grundfos.

2.2 UNDERCOUNTER PUMP

A. Pump: Simplex, submersible type, 1-1/2 in. discharge, cast iron construction, thermoplastic impeller.

B. Motor: Oil filled, permanent lubrication, inherent overload protection, water resistant power cord with plug.

C. Electrical Control: Built-in automatic diaphragm-type pressure switch.

D. Basin: Five (5) gallon polypropylene tank, 1-1/2 in. inlet, 1-1/2 in, outlet, 2 in. vent, filter trap with access cover.

E. See schedule on drawings for capacity and electrical characteristics.

F. Acceptable Manufacturers: Little Giant, Liberty Pumps, Hartell Pumps or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pumps shall be installed, aligned and started in accordance with manufacturers written installation instruction.

B. Install pumps in locations to provide access for maintenance and replacement of parts.

C. Support pumps and piping separately so that piping does not support pumps.

D. Provide the services of a factory trained mechanic to start up the system based on factory recommendations. Provide Owner instruction at time of start up. Submit three (3) copies of start up report to the Owner's Representative.

3.2 HOT WATER CIRCULATING PUMP

A. Install shutoff valve and strainer on pump suction; check valve, balancing valve and shutoff valve in pump discharge. Install pressure gauge on suction and discharge piping. Adjust gpm of each circulating pump to capacity as noted.

3.3 TESTING

A. Test hot water recirculating pumps for operation.

B. Certify in writing that tests have been performed and the systems are properly operating. Submit three (3) copies of all test reports to the Owner's Representative.

END OF SECTION

WATER SUPPLY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards, and listings/approvals:

1. ANSI/AWWA C600: AWWA Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

2. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

3. New York State Health Department.

4. Local municipality and fire department requirements and standards.

5. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.3 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this Section.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories" and Section 221020, "Underground Piping and Accessories".

2.2 WATER METER

A. Water Service: AWWA Standard Obtain meter from local Water Authority. Pay all costs. Shall meet local Water Authority Standards.

1. Acceptable Manufacturers: Mentrom-Farnier, Neptune.

2.3 BACKFLOW PREVENTERS AND ACCESSORIES

A. Reduced Pressure Type (Domestic Water - 2-1/2 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated, bronze relief valve.

2. Four (4) test cocks, epoxy-coated strainer, OS&Y resilient wedge gate valves.

3. Design Equipment: Watts Series LF009.

4. ASSE Standard 1013: AWWA Standard C511-92

5. Acceptable Manufacturers: Ames, Febco, Wilkins, Watts.

B. Double Check Valve Type (Water/Fire Service - 3 in. and Larger):

1. Cast iron body, stainless steel bolts and internal parts, removable bronze seats, epoxy coated.

2. Four (4) test cocks, OS&Y resilient wedge gate valves.

3. UL/FM listed and approved.

4. Same size as fire service.

5. Design Equipment: Watts Series LF774.

6. AWWA Standard C511-92

7. Acceptable Manufacturers: Ames Deringer, Febco, Wilkins, Watts.

C. Dual Check Type with Intermediate Atmospheric Vent (Coffee and Ice Machines):

1. Conforms to NSF Standard No. 25, stainless steel body, threaded end connections, rubber diaphragm, ball check, vent extended to drain.

2. Design Equipment: Watts 9BD.

3. Acceptable Manufacturers: Conbraco, Febco, Watts, Zurn.

D. Terminal Valve:

1. Cast iron body with flapper valve.

2. Design Equipment: Refer to drawings

3. Acceptable Manufacturers: J.R. Smith, Waterman.

2.4 VACUUM BREAKERS

A. Atmospheric Type:

1. Lead free brass body, silicone disc, ASSE 1001, threaded inlet and outlet connections, polished chrome for finished areas.

2. Design Equipment: Watts Series #LF288-A

3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

B. Hose Connection Type:

1. Brass body, stainless steel working parts, rubber diaphragm and disc, drainable, non-removable feature, polished chrome for finished areas.

2. Design Equipment: Watts #8A.

3. Acceptable Manufacturers: Watts, Conbraco, Zurn or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate work with all other trades and utility companies.

B. Inspect pipe, fittings and equipment prior to installation. Remove all defective materials from the site.

C. Do not backfill until inspection by Owner's Representative.

D. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.2 WATER SERVICE

A. Install all piping on firm bed, using caution where piping passes over excavation. Provide concrete thrust blocks to support hydrant and prevent movement at all changes in direction of piping. Thrust blocks not required for Type K copper piping installation. Provide rods, clamps and retainer glands on all elbows and fittings in accordance with manufacturer's recommendations to prevent fitting from blowing off under line pressure. Coat all clamps, rods, nuts with two coats of bitumastic.

B. Minimum earth cover shall be 5 ft. - 0 in. unless otherwise noted.

C. Water mains crossing sanitary or storm sewers shall be installed to provide a minimum vertical distance of 1 ft. - 6 inches between the outside of the pipes where the water main is above or below the sewer. Locate the water pipe so that the crossing of the sewer occurs at the mid-section of a full length of pipe. The minimum horizontal separation between water mains and sewer mains shall be 10 ft. - 0 in. measured from the outside of the pipes.

If separation or distance of joints from pipe crossing cannot be established, encase water piping in 6 in. concrete for a distance 10 ft. - 0 in. each side of crossing.

3.3 WATER METER

A. Provide pressure gauge on outlet side of meter. Provide line size strainer on inlet side of meter. Provide concrete base or pipe stands to support meter assembly. Provide bypass piping with sealed valve around meter.

B. The water meter assembly and piping arrangement shall be installed in accordance with the local Water Authority Standards.

3.4 BACKFLOW PREVENTERS

A. The backflow preventer installation shall be installed in accordance with the Health Department approved drawings.

B. Prior to installation of backflow preventers, obtain the approved drawings from the Engineer.

C. Provide hub style drain for emergency relief drain with a pipe separation of at least two (2) pipe diameters from backflow preventer relief outlet.

3.5 PIPING

A. Run slightly off level to low points; provide drain valves at low points. Provide shock absorbers where shown or specified. Branch headers serving flush valves shall be full size as shown. Exposed water piping in Kitchen shall be chrome plated brass (from insulation to fixture or equipment connection.). Provide dielectric pipe fittings when connecting to piping systems of dissimilar metals. All supply piping to fixtures, faucets, hydrants and flush valves shall be anchored to prevent movement.

B. Provide shock absorbers where flush valves and quick closing valves are used as specified in Section 223010.

3.6 ARRANGEMENTS

A. Provide for application to and obtain approval from the local Water Authority for connection to municipal systems.

B. Contact the Water Authority for the extent of their work, the costs, fees, required permits and their installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the base bid.

3.7 CLEANING AND DISINFECTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for domestic water piping cleaning and disinfecting requirements.

3.8 TESTS

A. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner.

B. Upon completion of construction, all backflow prevention devices provided under this contract shall be tested. Tests shall be performed by a certified backflow preventer tester registered by the New York State Department of Health. Provide three (3) copies of Form DOH-1013 for each device with Part A completed by the tester. Submit forms to Engineer. Pay all costs required for testing devices, including administrative costs associated with satisfying the requirements and regulations of Water Authority and Health Department. Repair or replace any device failing the test and repeat the test.

C. Test each vacuum breaker according to authorities having jurisdiction and the device's reference standard.

D. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION

SANITARY, WASTE AND STORM DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 PLUMBING DRAINAGE SYSTEM

A. Piping Materials: Refer to Section 221010, "Piping Systems and Accessories" and 221020, "Underground Piping and Accessories" for piping materials.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to commencing work, the Contractor shall verify inverts and locations. Any discrepancy between plans and field conditions shall be reported to the Owner or Engineer. No work shall start until discrepancies have been resolved. All costs related to Contractor's failure to verify and report discrepancies will be borne by the Contractor.

B. Install pipe and equipment in accordance with manufacturer's recommendations and in a workmanlike manner as determined by the Owner's Representative.

3.2 PIPE INSTALLATION

A. Minimum Slope: 2-1/2 in. and under - 1/4 in. per ft.; 3 in. to 6 in. - 1/8 in. per ft; 8 in. and larger - 1/16 in. per ft.

B. All underground sanitary piping shall be a minimum of 3 inch size and sloped no less than 1/4 inch per foot.

C. In all finished spaces, paint exposed waste piping 2 in. and over with chromium paint.

D. Slope piping as indicated on drawing; verify inverts given. Inspect piping before installation to detect apparent defects. Remove defective piping from site. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Install piping and gaskets in accordance with manufacturer's recommendations and other special installation requirements. Clean interior of piping of dirt and other foreign material as work progresses. Place plugs in ends of pipe at end of day or whenever work stops. Flush lines if required to remove collected debris.

E. Inspect piping to determine whether line displacement or other damage has occurred. Make inspections after lines have been installed and approximately 2 ft. of backfill is in place, and again at completion of project. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.

3.3 ARRANGEMENTS

A. Make arrangements and obtain approval of the local Sewer Department to connect to the municipal system.

B. Contact the local Sewer Department for the extent of their work, the costs, fees, required permits and installation requirements. Make all arrangements, pay all costs, fees and obtain all permits. Include all costs within the Base Bid.

C. Restore all areas disturbed to match existing.

D. The cleaning and flushing services shall be performed by one approved service firm.

3.4 TESTING

A. Refer to Specification Section 221010, "Piping Systems and Accessories" for pipe testing requirements.

END OF SECTION

EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Floors: Cast iron body, nickel-bronze top with adjustable feature, bronze plug and flashing clamp where required, carpet marker and tile cover where applicable; Jay R. Smith Series #4028.

B. Walls: Cast iron ferrule, with bronze plug and stainless steel smooth access cover.

1. Horizontal: Jay R. Smith Figure #4402.

2. Vertical: Jay R. Smith Figure #4531.

C. Yard Cleanout:

1. Cast iron body, adjustable round heavy duty top, with tractor cover, vandal proof screws and bronze plug; Jay R. Smith Figure #4246.

D. Make: Josam, Jay R. Smith, Mifab, Watts or Zurn.

2.2 SHOCK ABSORBERS

A. Hydropneumatically controlled with permanently sealed expansion chamber pre-charged with non-combustible gas; lead-free, threaded connection, meets or exceeds Plumbing and Drainage Institute Standard PDI WH-201 and ASSE Standard 1010.

1. Bellows Type: Stainless steel construction with stainless steel bellows.

2. Piston Type: Hard drawn copper body with brass piston, cap and adapter, and elastomer seals.

B. Elastomer or rubber compound type bellows not allowed.

C. Make: Watts #LF15M2, Precision Plumbing Products, Jay R. Smith, or Zurn.

2.3 WATER PRESSURE GAUGES

A. Pressure Gauge

1. Case: Stainless Steel case, non repairable

2. Dail Size: 3.5” Minimum

3. Media: Silicon Filled

4. Accuracy: 1%

5. Gauge Valve: Ball Valve

a. Guage cocks and Snubbers are not allowed

B. Make: Trerice, Weiss, Weksler, Winters.

2.4 PIPING SYSTEM THERMOMETERS

A. Industrial stick type

1. 9” aluminum or nonmetallic case, locking adjustable angle body, mercury free.

2. Secured to thermowell by tapered bushing

a. Set screws are not allowed

3. Thermowells: Brass

4. Accuracy: 1%

B. Light Powered Digital

1. Aluminum or high impact ABS case, glass passivated thermistor, LCD display, 0.5 inch minimum digits.

2. Secured to thermowell by tapered bushing

a. Set screws are not allowed

3. Thermowells: Brass

4. Accuracy: 1%

C. Make: Trerice, Weiss, Weksler, Winters.

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

A. Plumbing Contractor shall:

1. Provide all roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment requiring same as called for on Contract Documents.

2. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

3. Provide loose key stops, "P" traps, tailpieces, adapters, gas or air cocks and all necessary piping and fittings from roughing point to equipment.

4. Provide for installation of sinks, faucets, traps, tailpieces provided by an Equipment Contractor. These items to be delivered, in easily identified cartons, to the proper room for Contractor's installation.

5. Install controls and devices furnished by others.

6. Provide cold water line with gate valve and backflow prevention device at locations called for. Continuation and connection to equipment by others.

7. Install relief valve discharge piping from equipment relief valves.

8. Provide for Owner furnished equipment:

a. Connect complete and ready for use, including all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, etc., as required by Owner.

b. Refer to manufacturer Drawings and Specifications for requirements of Laboratory Equipment. Verify connection requirements before bidding.

3.2 CLEANOUTS

A. Install cleanouts out of traffic patterns and flush to floor. Provide offset from sanitary line served. Do not locate under doors or under lockers. Maintain distance between cleanouts on piping 4 in. and smaller, 50 ft.; over 4 in., 100 ft. At changes in direction greater than 45°. Install at base of soil, waste, vent, stacks and roof conductors and where called for.

B. Cleanouts: Same nominal size as pipe, but not larger than 4 in.

3.3 SHOCK ABSORBERS

A. Install in vertical position.

3.4 THERMOMETERS

A. Provide on piping system where called for and shown, with thermometer well at each location, mounted in oversize tee or elbow to provide as little restriction as possible to fluid flow, stems or proper length to allow accurate reading. Arrange to be easily read from floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.5 PRESSURE GAUGES

A. Provide in piping system where called for and shown, with needle valve and pulsation damper or snubber at each location. Arrange to be easily read from the floor.

B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.6 TEMPERATURE MIXING VALVE

A. Provide where called for. Provide 2 ft. - 0 in. deep heat trap on hot water supply line ahead of connection to mixing valve.

B. Provide factory-trained technician to start up, adjust and inspect the mixing valve and piping for correct installation and temperature adjustment.

END OF SECTION

COMPRESSED AIR AND VACUUM EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and other services to perform operations required for the complete installation and related work as required in the Contract Documents.

B. Equipment listed in this section shall be used for laboratory and general use only.

1.2 SUBMITTALS

A. Submit shop drawings for all items specified in this section under Part 2 - Products.

1.3 EQUIPMENT MANUFACTURER

A. All system equipment specified under this section shall be provided by the same supplier.

B. Make arrangements for supplier's representative to supervise, inspect and test installation to assure system operates as specified.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PIPING

A. Refer to Specification Section 221010, "Piping Systems and Accessories".

B. Connections: All brazed connections except valves or equipment requiring threaded connections.

C. Fittings:

1. Compressed Air: Brazing type fittings.

2.2 VALVES

A. Refer to Specification Section 220523, "Valves".

2.3 COMPRESSED AIR SYSTEM

A. Provide Quincy Model QT-10, or equivalent Gardner Denver, Ingersoll-Rand or Champion, base mounted, simplex compressors and motors, rated to produce a total of 36 ACFM at 150 psig, and a maximum pressure of 175 psi. The compressor motor shall be NEMA rated, 10 HP at 208 volts, 60 Hz, three phase.

1. Receiver shall be ASME rated for 175 psig working pressure with liquid level gauge glass, safety relief valve, manual drain valve and a timed automatic solenoid drain valve. Tank shall be horizontal with a capacity of 120 gallons.

2. Automatic start and stop operation duplex NEMA 12 control panel, with automatic lead/lag sequencing, circuit breaker disconnects for each motor, 120V control circuit transformer, audible and visual alarms, automatic alternation and Hand-Off-Automatic selector switches for each compressor. Provide two (2) year warranty.

B. Refrigerated Dryer:

1. General: Provide Quincy Model QPNC-64 refrigerated air dryer or approved equal capable of reducing the temperature of 64 SCFM air at 100 psig to a pressure dew point (33°F to 39°F). Include with automatic drain valve.

2. Dryer shall incorporate a hermetically sealed air cooled refrigeration compressor/condenser and liquid refrigerant filter dryer.

3. Dryer shall be equipped with a panel mounted evaporator light, power-on light and pre-wired power cord.

4. Electrical Requirements: 208 volts, 60 Hz, three phase.

C. Air Filters Coalescer:

1. Provide Quincy Model QMF 50 high efficiency oil removal filtration filter to remove water, solids and oils from 50 SCFM of air at 100 psig and capable of removing particles as small as 0.01 micron.

D. Air Filters Polisher:

1. Provide Quincy Model QCF 50 high efficiency oil removal filtration filter to remove water, solids and oils from 50 SCFM of air at 100 psig and capable of removing particles as small as 0.01 micron.

E. Dew Point Hygrometer/CO Monitor:

1. The package shall incorporate a dew point hygrometer and CO monitor, both pre-wired to include remote alarm contacts and shall be pre-piped.

2. The CO sensor shall be chemical type with system accuracy of ±2 ppm (at 10 ppm) for carbon monoxide. Dew point alarm shall be factory set at 30°F and CO alarm factory set at 10 ppm. Wire to building management system.

F. Pressure Regulating Valves:

1. 2 in. and Smaller: Bronze body with threaded ends, bronze trim, brass strainer screen, neoprene diaphragm and steel pressure spring.

2. Design Equipment: Cash Acme No. E-55, arranged for compressed air.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Installations:

1. All work in this section shall be done in accordance with the equipment manufacturer's installation instructions and the latest applicable Codes and NFPA requirements.

2. Provide rigid supports for all valves and equipment to avoid strain on piping.

B. Cleanouts:

1. Install cleanouts in vacuum piping at the top of each riser, at all 90° turns, etc. Use only "Y" type fittings; tees are not acceptable.

3.2 TESTING

A. After installation of tubing but before connecting to system components, test piping sections with a minimum 150 psig of oil free dry nitrogen.

1. Test each joint for leaks by means of soap suds.

2. All leaks shall be located, repaired and piping retested.

3.3 EQUIPMENT START-UP

A. Provide equipment start-up services by a factory-authorized technician based on factory recommendations. Technician shall inspect the work for proper installation, operation and to confirm specified operating parameters. Submit three (3) copies of startup reports with all factory checkout data in writing to the Owner's Representative.

END OF SECTION

WATER HEATERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work of this section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions, General Requirements and Basic Mechanical/Electrical Requirements.

B. Provide labor, materials, equipment and services to perform work and related work required by Contract Documents for a complete operating system.

1.2 SUBMITTALS

A. Submit manufacturer's data for approval in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all products to be installed including, but not limited to:

1. Water Heater.

2. Protective Valves.

3. Expansion Tank.

4. All Heater and Tank Accessories.

5. All System Wiring Diagrams.

1.3 SPECIAL COORDINATION

A. Coordinate all work of other trades in Mechanical Room.

B. Furnish Division 26 "Electric" with dimensional drawings showing location of electrical connections, location of equipment mounted on walls, and of other equipment requiring electrical connections, removals or replacements.

PART 2 - PRODUCTS

2.1 WATER HEATER – WATER TO WATER PACKAGED WATER HEATER

A. Mounted on 16 gauge enameled metal bare, factory assembled including electronic operated 3 way valve.

B. Bronze T & P relief valve conforming to ANSI Z21.22 and 2” bronze ball type shell drain valve.

C. Double walled copper, brazed 316L stainless steel plates.

D. Refer to drawings for Water Heater Schedule.

E. Accessories:

1. Microprocessor based temperature controller.

2. Over temperature limit system.

3. Temperature switch.

4. Solenoid valves.

5. Indicator lights.

6. Hot water outlet temperature.

7. Pressure temperature relief valves.

F. Design Equipment: Cemline.

G. Acceptable Manufacturers: Aerco, Cemline.

2.2 THERMAL EXPANSION TANK

A. Vertical steel expansion tank constructed and designed per ASME Code Section VIII, 125 PSI working pressure, steel outer shell, rigid polypropylene liner, heavy duty butyl rubber diaphragm and non-ferrous system connection tapping, suitable for potable hot water, factory pre-charged.

B. Design Equipment: Amtrol.

C. Acceptable Manufacturers: Amtrol, Watts, Wessel or approved equal.

2.3 PROTECTIVE VALVES

A. Pressure Relief Valves:

1. ASME stamped and rated.

2. Open at 125 lbs. pressure sized for full heating capacity.

3. Make: Bell & Gossett, Kunkle, Watts or approved equal.

B. Temperature and Pressure Relief Valve:

1. ASME stamped and rated (for steam or hot water).

2. Size for full heat input.

3. Complying with Federal Spec. MIL-V-13612C.

4. Valve shall be sized and selected by manufacturer for tank and heater installed.

5. Make: Camco, Cash-Acme, Watts, or approved equal.

PART 3 - EXECUTION

3.1 WATER HEATERS

A. Install each heater on a 6 in. high concrete pad.

B. Pipe pressure and temperature relief valve drain to discharge to nearest floor drain.

C. Provide all electric wiring and equipment in accordance with manufacturer's wiring diagrams and instructions. Make all final connections.

D. Provide all piping, valves and fittings in accordance with manufacturer's piping instructions. Make all final connections.

E. Provide equipment in accordance with contract drawings and all local codes.

F. Provide start-up services of a factory trained technician to inspect the installation based on factory recommendations. Items include but are not limited to:

1. Verification of proper piping arrangement.

2. Verification of proper temperature rise across heater(s).

3. Operating and safety controls.

4. Proper operation of equipment.

5. Verification of piping arrangement and aquastat location.

6. Relief valve settings and AGA BTU capacities.

7. All control settings.

G. Submit three (3) copies of startup reports in writing with all factory checkout data signed by the factory authorized service agent to the Owner's Representative.

H. Place equipment in operation.

I. The installation of water heaters shall be based on the details shown on the drawings and specified in this Section. Approved water heaters provided other than type shown or specified shall be installed in accordance with manufacturer's recommended installation instructions and piping diagrams.

3.2 INSTANTANEOUS WATER HEATERS

A. Install instantaneous type water heaters as recommended by the manufacturer. Place and secure anchorage devices to building structure. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible.

END OF SECTION

PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.

B. Provide submittals for all items specified under Part 2 - Products of this section.

1.3 DESCRIPTION OF FIXTURES

A. Fixtures and trim shall be of those manufacturers listed, unless otherwise indicated. Fixtures for this project shall be of same manufacturer.

1. Fixtures: American Standard, Kohler, Mansfield, Sloan, Toto, Watts or Zurn.

2. Faucets: Chicago Faucets, Delta, Moen, Symmons, T&S Brass or Zurn. All faucets shall be lead-free in accordance with NSF 61 and NSF 372.

3. Fixture Carriers: Jay R. Smith, Watts, Wade, Josam or Zurn.

4. Sinks: Elkay, Just or Kohler.

5. Water Coolers: Elkay, Haws, Murdock or Oasis.

6. Supplies, Stops and Traps: Brasscraft, EBC, McGuire or Sanitary Dash.

B. Exposed parts of trim shall have polished chrome plated finish.

C. Tubular drainage products ("P" traps, nipples, etc.) shall be 17 gauge brass.

1.4 QUALITY ASSURANCE

A. Comply with requirements of the Plumbing Fixture Law of the New York State Department of Environmental Conservation.

B. Comply with the American Disabilities Act Guidelines and ANSI A117.1 "Accessible and Usable Buildings and Facilities".

C. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard 61, Section 9 Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third-party testing and certification.

D. All fixture trim used to convey water for potable use shall be lead free.

PART 2 - PRODUCTS

2.1 SINKS

A. SK-A (HDCP):

1. Elkay Lustertone ELUHAD211555PD, 23 1/2 in. x 18 1/4 in. x 5 3/8 in. deep, nickel type 304 stainless steel single bowl sink, ADA compliant, 18 gauge, undermount installation, fitted with the following:

a. Chicago #786-GN8AE29ABCP two handle concealed mount sink faucet, 11-5/8 in. high, 5 3/8 in. reach swing spout, pressure compensating aerator, deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:

1) 1.5 GPM aerator.

2) #317, 4 in. wrist blade handles

b. Elkay #LKAD18 stamped brass drain outlet with 3 in. perforated grid strainer and LKADOS 1-1/2 in. O.D. offset tailpiece.

c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

B. SK-B (HDCP):

1. Elkay Lustertone ELUHAD211555PD, 23 1/2 in. x 18 1/4 in. x 5 3/8 in. deep, nickel type 304 stainless steel single bowl sink, ADA compliant, 18 gauge, undermount installation, fitted with the following:

a. Chicago #786-GN8AE29ABCP two handle concealed mount sink faucet, 11-5/8 in. high, 5 3/8 in. reach swing spout, pressure compensating aerator, deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:

1) 1.5 GPM aerator.

2) #317, 4 in. wrist blade handles

b. Elkay #LKAD18 stamped brass drain outlet with 3 in. perforated grid strainer and LKADOS 1-1/2 in. O.D. offset tailpiece.

c. Sediment Trap: Streim Sidekick

d. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

e. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

C. SK-C (HDCP):

1. Elkay Lustertone ELUHAD211555PD, 23 1/2 in. x 18 1/4 in. x 5 3/8 in. deep, nickel type 304 stainless steel single bowl sink, ADA compliant, 18 gauge, undermount installation, fitted with the following:

a. Chicago #434-ABCP single handle concealed mount sink faucet, 17 in. high, 8 1/4 in. reach swing spout, pressure compensating aerator, deck mounted, lead-free, ADA compliant and fitted with the following:

1) 1.5 GPM aerator.

b. Elkay #LKAD18 stamped brass drain outlet with 3 in. perforated grid strainer and LKADOS 1-1/2 in. O.D. offset tailpiece.

c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

D. SK-D (HDCP):

1. Elkay Dart Canyon Farmhouse Workstation ELDSSF30279DBG, 29 1/2 in. x 27 1/4 in. x 9 5/8 in. deep, with 4 13/16 shelf, nickel type 304 stainless steel single bowl sink, ADA compliant, 16 gauge, fitted with the following:

a. Chicago #786-GN8AE29ABCP two handle concealed mount sink faucet, 11-5/8 in. high, 5 3/8 in. reach swing spout, pressure compensating aerator, deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:

1) 1.5 GPM aerator.

2) #317, 4 in. wrist blade handles

b. Elkay #LKAD18 stamped brass drain outlet with 3 in. perforated grid strainer and LKADOS 1-1/2 in. O.D. offset tailpiece.

c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.

d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

2.2 EMERGENCY FIXTURES

A. EEW-A: (for the physically challenged)

1. Water Saver EW805-TMV, Deck mount eyewash unit, 90° swivel with stay open valve, and backflow preventer, universal identification sign and meeting ANSI Z358.1, with emergency fixture thermostatic mixing valve meeting ASSE 1071, and cold water by-pass.

B. ES-A: EMERGENCY SHOWER:

1. Water Saver SS996, drench shower meeting 2358.1, 1" NPT stay open valve.

PART 3 - EXECUTION

3.1 FIXTURES, EQUIPMENT AND SYSTEMS

A. Install fixtures, equipment and systems as shown on Drawings or specified herein in accordance with provisions of each applicable Specification Section and all local and state codes having jurisdiction.

3.2 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers written installation instructions.

B. Carefully drill holes for through bolts to avoid chipping blocks or plaster.

C. Except where carriers are specified, attach hangers or brackets to walls as follows:

1. Masonry Construction: Secure fixture hangers to partition by thru-bolts extending through a steel plate on opposite side of partition. Obtain Owner's Representative's approval prior to work.

2. Metal Stud Construction: Anchor backing for fixtures or equipment to 1/8 in. x 12 in. steel plate bolted or riveted to at least three studs. Obtain Owner's Representative's approval prior to work.

D. Anchor carriers to concrete floor with 1/2 in. x 3 in. anchor or thru-bolts and washers. Provide for drilling of floor and installation of expansion shields. Quantity of anchors:

1. Water Closets - Four (4).

2. Lavatories - Eight (8).

E. Seal fixtures in contact with walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone caulk. Match color to fixture color.

F. Set self-rimming lavatories and sinks in a bed of silicone caulk.

G. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.

H. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.

I. Fasten counter-mounting-type plumbing fixtures to casework.

J. Immediately after installation, provide protective covering over fixtures and trim.

3.3 MOUNTING HEIGHT AND LOCATION

A. Mount fixtures at height and location as indicated on Architectural plans and elevations.

B. Mount accessible fixtures in conformance with the requirements of ANSI A117.1.

3.4 CONNECTIONS

A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

3.5 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Adjust water pressure at electric water coolers, faucets and flush valves to provide proper flow and stream.

C. Replace washers of leaking and dripping faucets and stops.

D. Clean fixtures, fittings, spout and drain strainers with manufacturers' recommended cleaning methods and materials.

E. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components and retest. Repeat procedure until all units operate properly.

END OF SECTION

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final hot water, glycol, chilled, drain, vent**,** connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding.

END OF SECTION

ELECTRIC WIRING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services for the complete installation of motor control wiring and temperature control wiring as required in Contract Documents. Provide wiring and conduit, required to connect devices furnished as part of or adjunctive to the automatic temperature control system and for motor control regardless of the source of supply. Control wiring includes 120 volt, lower voltage wiring and data network system for control signals directing equipment operation. Control circuits shall be 120 volt maximum. Provide wiring in accordance with requirements specified in Division 26 "Electrical" and the National Electrical Code. Provide devices required for proper system operation, including special electrical switches, transformers, disconnect switches, relays, and circuit breaker protection.

B. Coordinate all work with Division 26 "Electrical".

C. Coordinate all work with Division 27, "Communications".

1.2 WORK NOT INCLUDED

A. Power wiring for motors, motor starters and associated starting and control equipment, as well as the motor starters (except in the case of equipment specified to have packaged control/starters), are included in Division 26 "Electrical", unless otherwise called for.

1.3 QUALIFICATIONS

A. Wiring shall be installed in compliance with all requirements of Division 26 "Electrical".

B. Wiring shall be installed in compliance with all requirements of Division 27, "Communications".

1.4 SUBMITTALS

A. Provide complete wiring diagrams for equipment systems. Deliver wiring diagrams to proper trades in time for roughing of conduit, equipment connections, and avoid delay in construction schedule. Wiring diagrams and roughing information to be wired as part of the Work of Division 26 & 27, "Electrical" & “Communications”, shall be clearly indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Control Wiring:

1. Refer to Division 26 specifications for required wiring materials.

2. Unless specifically required otherwise by the BACS equipment manufacturer, all I/O wiring shall be twisted shielded cable.

B. Conduit:

1. Refer to Division 26 specifications for type of conduit to be used in specific applications.

2. All conduit containing control wiring shall be green.

PART 3 - EXECUTION

3.1 GENERAL

A. Check electrical wiring pertaining to equipment for completeness and correctness of connections. Correct any misapplied motor and/or motor starter, improper thermal overload device, or device which fails to function and resultant damage, whether due to incorrect connections or improper information on wiring diagrams.

3.2 WIRING FOR CONTROL SYSTEMS

A. Provide motor control and temperature control wiring for equipment. All wiring shall be in conduit, unless otherwise noted below, supported on 5ft. centers.

1. Provide 18 in. length flexible conduit at motors and devices subject to vibration.

2. Do not attach directly to hot surfaces, piping, or ductwork.

3. Control wiring shall be in separate conduit and raceway from all other wiring.

4. Control wiring shall be un-spliced from the controller to the sensor or device and shall be labeled at all points of termination.

5. For sensors with twisted shielded pair cable, the shield shall be ground at the panel and taped back at the sensor.

6. All control wiring shall be run in conduit within the following locations:

a. Mechanical rooms or other spaces in which it is readily accessible.

b. Interstitial spaces

1) Control wiring can be run in either conduit, cable tray or raceway.

c. Vertical chases.

d. Above non-accessible ceilings.

e. Accessible ceilings within laboratories.

f. Air Handling Units.

7. Where allowable by Code and contract documents, temperature control wiring may be installed without conduit.
Installation and wire insulation types shall be as described by NEC, Article 725.
All low voltage wiring circuits 50 volt and under shall:

a. Have the proper insulation and meet the requirements of NEC Article 300-22 when installed above accessible ceiling spaces.

b. Be adequately supported using bridle rings spaced a maximum of 3 ft. on centers or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.

c. Be run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.

d. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.

B. Provide pushbutton stations, pilot lights, selector switches, auxiliary starter contacts, and other devices required to provide specified functions.

1. Provide green grounding wire circuited from starter and run ground wire through conduit to each remote auxiliary relay, pushbutton station, remote panel heating device, thermostat, or device with potentials in excess of 50 volts. Size ground wire as required by NEC.

3.3 EQUIPMENT WIRING

A. Provide power and control wiring between sections of electrical radiation units, between shipping splits, and between remote panels, thermostats, disconnect switches, and their respective units. Provide control wiring from the package control system to each respective electric heat coil, reheat coil or motor. Properly mount control package. Power wiring to and including disconnect switch shall be by Division 26, "Electrical".

3.4 FIELD WIRING IN STARTERS, CONTROLLERS AND PANELS

A. Wiring within starters, controllers, and temperature control panels, shall be routed neatly in gutter space, away from moving and/or heat producing parts. Provide suitably rated terminal blocks. Do not place more than two wire connections on pilot device or relay terminal. Where more than two circuit connections are required, use terminal blocks. Provide nylon insulated, ring spade terminal for all control wires. Cables and wires shall be neatly bundled and lashed with nylon cable straps.

END OF SECTION

MOTORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Submit manufacturer's product data on all motors.

B. Product Data: For each motor, provide dimensions; mounting arrangements; frame type, enclosure type, location for conduit entries; shipping and operating weights; and manufacturer's technical data on features, performance, electrical ratings and characteristics.

C. Motor Performance Data: For each motor, include the following manufacturers' data:

1. Motor Performance: Percent Efficiency, Power Factor, Torque, RPM, Duty Rating and Design Category.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Motor manufacturer shall be based and headquartered in the United States of America and shall design and manufacture motors in the United States.

2. Motor manufacturer shall have over fifteen (15) years-experience in the motor industry and shall maintain active company-wide quality assurance program.

3. Motor manufacturer shall maintain an authorized service center within 60 miles of the project site, capable of providing training, parts and emergency maintenance and repairs.

B. Motor performance shall be warranted against material and workmanship defects by manufacturer's limited warranty and service policy for the period of at least 18 months from the day of shipment from the factory or the manufacturer's warehouse.

1. Premium efficiency motors shall be warranted for 36 months.

2. Severe duty motors (as applicable) shall be warranted for 60 months.

3. Extended warranty shall be offered for certain products or as agreed by additional terms and specified elsewhere.

PART 2 - PRODUCTS

2.1 MOTORS

A. General Requirements:

1. Motors built for 60 Hz operation, three phase for 1/2 HP and larger; single phase for 1/3 HP and smaller.

a. In compliance with NEMA Standards, wound specifically for nameplate voltage, and selected for appropriate duty and environment.

b. 1.15 minimum service factor at rated voltage and frequency. 1.0 service factor for inverter duty motors.

c. Bearings: Bearings shall have a rated fatigue life of L-10 (B-10) of 150,000 hours for direct-coupled applications and 50,000 hours for belted applications minimum. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG 1-14.43. The calculation will be determined from the pulley centerline being at the end of the motor shaft.

d. V-belt connected motors with adjustable slide rail bases and pulleys.

e. Motors shall have Class F insulation system, with Class B temperature rise, insulation meeting NEMA MG 1 Part 31. Maximum allowable motor temperature rise for open drip-proof or totally enclosed fan cooled (TEFC) type at 1.15 service factor shall be 105°C above 40°C ambient with a total temperature rating of 155°C.

f. NEMA locked rotor kVA code as required to match unit equipment torque characteristics.

g. Single-phase motors shall be capacitor start, induction run, or split phase type.

h. Polyphase motors shall be constant speed, squirrel cage, unless otherwise specified.

i. Nameplates shall have as a minimum, all information as described in NEMA Standard MG-1-20.60. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins.

2. Motors for use with adjustable speed drive applications shall be premium efficiency inverter duty rated in accordance with NEMA and be capable of a 20:1 turndown.

a. These motors shall meet NEMA corona inception voltage requirements, withstanding peak voltages up to 1600 volts, and be manufactured in accordance with NEMA MG 1 Part 30 and 31.

b. All motors controlled by adjustable speed drives shall be equipped with circumferential micro-fiber shaft grounding rings to provide protection from electrical bearing damage, to meet NEMA MG 1, 31.4.4.3. Provide AEGIS Bearing Protection Ring Kit (or equal), installed in accordance with the manufacturer's recommendation. For motors controlled by adjustable speed drives and 50hp or greater the motor shall have a ceramic electrically insulating bearing assembly on the opposite end of the grounding brushes

3. EC Motors:

a. The motor shall be DC rated with permanent magnet rotor and automatically resetting integral overload protection.

b. The unit shall meet the scheduled voltage, phase, control and other requirements indicated.

c. Input Control: The unit shall have the following control features as a minimum:

1) Packaged Unit controls: DDC input to include start/stop/status/general trouble.

2) External Control: BACnet digital start/stop, digital trouble, 0-10VDC and 4-20mA speed control input.

d. Unit insulation shall be Class H.

e. Electrical termination lugs shall be suitable for the intended feed circuit.

f. Ratings shall be 90% minimum power factor and 10% maximum total harmonic distortion.

g. Speed control suitable for 100% to 10% operational capability.

h. Fully programmable and reviewable settings and parameters.

i. Suitable for operation at ambient conditions of 32 to 104 degrees F.

j. The power circuiting shall be separated from the low voltage control circuiting.

k. Output parameters where indicated:

1) Speed.

2) Trouble indication.

3) Overload indication.

4. Three phase motors rated 1 HP and greater shall be copper winding, re-lubable ball bearings, 1.15 service factor (1.0 service factor for inverter duty motors), premium efficiency, energy-saver type with a guaranteed NEMA nominal full-load efficiency, by IEEE Standard 112 Test Method "B". Efficiency rating shall appear on nameplate, and shall be not less than as follows; per NEMA MG 1 Part 12, Table 12-12, nominal minimum efficiencies:

MINIMUM NOMINAL FULL-LOAD MOTOR EFFICIENCY						
HP	ODP MOTORS (RPM)			TEFC MOTORS (RPM)		
	1200	1800	3600	1200	1800	3600
1.0	82.5	85.5	77	82.5	85.5	77.0
1.5	86.5	86.5	84	87.5	86.5	84
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4

5. Nominal Motor Voltage Table:

Nominal System Voltage	Motor Nameplate
480V - 3 phase	460 volt
240V - 1 phase and 3 phase	230 volt
208V - 1 phase and 3 phase	200 volt
120V - 1 phase	115 volt

6. Motor Application; Provide the following enclosure types unless noted otherwise:

Environment/Location	Motor Enclosure Type
General Purpose	Open drip-proof, TEFC with cast iron frame, or encapsulated
Outdoors, below grade or high humidity	TEFC with cast iron frame
Hazardous	Explosion-proof
Packaged Refrigeration Compressors	Hermetic or semi-hermetic

7. Acceptable Manufacturers: Motors need not all be of the same manufacturer. Subject to the requirements of this section provide products by the following:

   a. General Electric Energy & Saver NEMA Premium Efficiency/(ODP); General Electric X$D Ultra NEMA Premium Efficiency (TEFC).

   b. Baldor-Reliance Super E.

   c. Marathon XRI.

PART 3 - EXECUTION

3.1 MOTORS

A. Furnished by equipment manufacturer and specially manufactured and/or selected, mounted, and installed for intended use. Install motors accessible for maintenance and belt adjustment.

END OF SECTION

GAUGES AND THERMOMETERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

A. Submit product data for gauges, thermometers and thermowells.

PART 2 - PRODUCTS

2.1 WATER PRESSURE GAUGES

A. Bourdon tube type, 3-1/2 in. diameter minimum, dial face, non-repairable, stamped stainless steel case, acrylic lens, with snap-on rings. Silicon filled, phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip. 1/4 in. bottom connection. Accuracy, one (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with shut-off ball valve.

B. Make: American, Moeller, Trerice, Weiss, Weksler, Winters.

2.2 PIPING SYSTEM THERMOMETERS

A. Industrial type, plastic, aluminum or steel case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks where required; range as called for service. Universal adjustable type, 9 in. scale. For installation in hot water systems, graduations of 2°F., accurate to within 1°F. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F.

B. Industrial type, plastic or aluminum case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks where required; range as called for service. Universal, locking, adjustable type, 9 in. scale. For installation in hot water systems, graduations of 2°F., accurate to within 1°F. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F.

C. Make: American, Moeller, Trerice, Weiss, Weksler, Winters.

2.3 DIGITAL LIGHT POWERED THERMOMETER

A. High impact ABS case. Range for -40° to 300°F, 1/2 in. LCD display. Accuracy of 1% of reading or 1°F, whichever is greater. 1/10° resolution. Internal potentiometer for recalibration. 10 LUX rating. 10 second updates.

Ambient operating range of -30° to 140°F. Glass passivated thermistor sensor. Industrial glass stem assembly. Provide suitable thermowell and extension neck where required.

B. Make: Weiss, Winters.

2.4 THERMOWELL

A. All thermowells for steam service shall be stainless steel and for water service shall be brass. Thermowell length shall be in accordance with ISA Standards and shall include the appropriate extension to allow for pipe installation. Extension neck shall be included when required to match thermowell and insulation thickness.

B. Make: American, Moeller, Trerice, Weiss, Weksler, Winters.

2.1 PRESSURE/TEMPERATURE TEST PLUGS

A. 1/4 in. NPT plug shall be capable of reading either pressure or temperature. Use extended body style to allow for insulation thickness. 1/8 in. o.d. rated for 275°F with zero leakage from vacuum to 500 psig with dual seal core material as follows:

1. Hot water, Glycol - Nordel (EPDM) seat.

2. Chilled water, Cold water - Neoprene seat

B. Test kit consisting of: one 2-1/2 in. test gauge 0-100 psi, one gauge adapter 1/8 in. probe, and two 5 in. stem pocket testing thermometers - one 0° to 220° and one 25° to 125°F.

C. Makes: Peterson Equipment Company, Sisco P/T plugs.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide where called for in the drawings and as noted below.

B. All gauges and thermometers shall be provided with pressure and temperature ranges appropriate for the system in which they are installed. Select to operate in the middle third of the range under normal operating conditions. Gauges and thermometers shall be suitable for the environment of their installed location, and if installed outdoors shall be acceptable for operation down to an ambient temperature of -20°F.

D. On devices such as pumps, strainers, coils, etc., where the differential pressure is the desired information, install only one pressure gauge with valved connections to the upstream and downstream taps. Provide P/T test port in addition to the pressure gauge. Provide a second set of isolating valves at the gauge if gauge location is not within reach of tap points.

3.2 WATER PRESSURE GAUGES

A. Provide gauge valve at each pressure gauge. Valve shall be 1/4 shut-off ball valve. Gauge cocks and needle valves are not allowed.

B. Heating water and chilled water coils: 0 to 60 psi range.

C. Provide 1/4 in. ball valve in each pump inlet and outlet tapping, or in piping adjacent to same. Range 30 in. vacuum to 100 psi.

D. Heat exchangers: 0 to 60 psi range.

E. Compression tanks: 0 to 100 psi range.

F. Each water make-up valve assembly: 0 to 60 psi range.

3.3 THERMOMETERS

A. Provide thermowells mounted in oversize tee, or elbow if necessary, to provide as little restriction as possible to fluid flow. Provide thermometer stems and thermowell depths of proper length to allow accurate reading. All thermometers shall be secured to the well by tapered bushing and not set screws. Locate adjacent to control sensing equipment. Install and adjust angles so as to be easily read from floor.

B. Cooling Coil: Inlet and outlet; range 20° to 120°F.

C. Chilled Water Entrance: Supply and return; range 20° to 120°F.

D. Heat Exchanger: Inlet and outlet; range 30° to 300°F.

E. Hot Water Zone: Supply and return pipe; range 30° to 300°F.

F. Heating Coil: Inlet and outlet; range 0° to 220°F.

3.4 TEST PLUG

A. Provide test plugs at locations as called for. In addition, test plugs shall be provided on each coil bank, heat exchanger, fan coil and at all permanent pressure gauge location.

B. Deliver test kit to Owner and obtain receipt.

C. Provide a minimum of ten (10) test plugs to be installed at location(s) identified by Cx Agent. Contractor shall request locations prior to filling the system(s).

END OF SECTION

VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation and related Work designed in Contract Documents.

1.2 SUBMITTAL

A. Submit product data for valves and accessories.

PART 2 – PRODUCTS

2.1 GENERAL

A. Valves shall have following requirements:

1. Working pressure stamped or cast on bodies.

2. Manufacturer valve tag identifying the valve type and major component materials.

3. Stem packing serviceable without removing valve from line.

4. Valves on insulated services shall have handle extensions so that the handle is fully beyond the insulation jacketing.

5. Where possible, all valves of like type shall be of a single manufacturer.

6. Plug or gate valves shall not be used on any services.

7. Unless otherwise noted, all valves for shut-off and bypass service shall be as follows:

a. NPS 2 in. and below: Ball valve with thread, sweat, or socket weld connections. All lead free bronze valves shall have threaded connections.

b. NPS 2-1/2 in. and above: Butterfly valves with flanged/lugged connections.

c. NPS 2-1/2 in. and 3 in. copper piping systems: Ball valves with sweat or threaded connections.

d. 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.

8. All valves for all services shall be fully bi-directional and suitable for dead end service.

9. Insulated valves shall have extended handle stems.

10. On all valves the packing compression is to be independent of the stem, ball or handle systems. All valve stems are to be blowout proof. Packing shall be accessible without disturbing the insulation.

11. Combination devices and pre-piped manufacturer coil fit out kits are not permitted, including but not limited to the following:

    a. Manual balance, control, ball isolation valves

    b. Manual balance, strainer, ball isolation valves (TDV)

    c. Y-strainer, ball isolation valves

    d. Ball isolation, drain valves

    e. Balancing, shutoff valves

B. Acceptable Manufacturers:

1. Ball Valves: See below for acceptable manufacturers and models.

2. Butterfly Valves: See below for acceptable manufacturers and models.

3. Check Valves: Apollo, Hammond, Milwaukee, Nibco, Watts.

4. To establish a standard of quality and to identify features, certain manufacturers' numbers are given in the following paragraphs.

2.2 BALL VALVES

A. General Duty

1. For all water services, low pressure steam, low pressure condensate and all other normal non-corrosive services, ball valves shall be as follows:

a.	Body	Bronze or Lead-Free Bronze
b.	Body Style	Full Port, Two piece
c.	Trim	316 Stainless Steel Ball and Stem
d.	Seat	Reinforced Teflon (RTFE), 15% glass filled double seal
e.	WOG Rating	300 psig Minimum
f.	Saturated Steam Rating	150 psig Minimum
g.	Actuator	Lever handle

2. Acceptable Models:

a.	Apollo	70-140, 70-240, 77CLF-140
b.	Nibco	T-585-70-66, S-585-70-66, T-585HP-66-LF
c.	Watts	LFB6080-G2-SS

B. Hose Connection

1. 1/2 in. and 3/4 in. hose connection ball valve shall be as:

a.	Body	Lead Free Bronze
b.	Body Style	Full Port, Two piece
c.	Trim	316 Stainless Steel Ball and Stem
d.	Seat	PTFE or TFE
e.	Seat Working P/T Rating	300 psig @ 250°F Minimum
f.	WOG Rating	300 psig Minimum
g.	SWP Rating	150 psig Minimum

2. Acceptable Models:

a.	Apollo	70LF-140-HC
b.	Nibco	T-585-66-LF-HC

2.3 BUTTERFLY VALVES

A. General Duty

1. For all water services and all other normal, non-corrosive services, butterfly valves shall be single offset as follows:

a.	Body	Ductile Iron or Cast Iron
b.	Body Style	Fully Lugged
c.	Trim	316 or 17-4 pH Stainless Steel
d.	Disc	Stainless Steel
e.	Seat	EPDM –resilient seat fully bi-directional dead-enabled
f.	Seat Working P/T Rating	150 psig @ 250°F Minimum

	g.	Body Working P/T Rating	ANSI 150 Minimum
	h.	Actuator	Under 4 in. – Locking Lever Handle 4 in. and above – Handwheel Gear Operator

2. Acceptable Models:

a.	Keystone	Series 60
b.	Nibco	LD-3022
c.	Watts	BF-03

B. High Performance, Water Service Building Entrance

1. Butterfly valves shall be double offset as follows:

a.	Body	Ductile Iron or Carbon Steel
b.	Body Style	Tapped Lug (Full Flange)
c.	Trim	316 Stainless Steel
d.	Disc	316 Stainless Steel
e.	Seat	PFTE – resilient seat fully bi-directional dead-enabled
f.	Seat Working P/T Rating	100 psig @ 375°F Minimum
g.	Body Working P/T Rating	ANSI 150 Minimum
h.	Actuator	Under 4 in. – Locking Lever Handle 4 in. and above – Handwheel Gear Operator

2. Acceptable Models:

a.	Keystone	K-LOK F362
b.	Metso Jamesbury	815L
c.	Tri-Seal Contromatics	QF-1151

2.3 CHECK VALVES

A. 2 in. and Smaller: Bronze, swing check, threaded or soldered ends, 125 SWP, Milwaukee 1509.

B. 2-1/2 in. and Larger: Cast iron body, 304 stainless steel seat, disc, spring, bushing and screw, 125 lb. SWP. Milwaukee 1400. Double disc or bi-folding disc type valves are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Provide valves of type called for and where required to service equipment.

2. Provide at major building and systems sections.

3. Provide chain wheels, guides, and chain loops for valves, where called for or in Mechanical Rooms where valves are mounted higher than 8’-0” AFF.

4. Isolating valves for individual fan convectors, room units, terminal units, or other similar apparatus may be inside cabinet or at connection to branch mains where accessible.

5. Locate valves with handles at horizontal position when 5 feet or more above the floor, for greater visibility. Otherwise, locate valves with handles at or above horizontal position. Swing check valves in upright position only.

6. Provide hose threaded valves at low points, strainers, equipment, and as called for.

7. Install valves after welding adjacent to valve is complete to protect seat and disk.

8. The use of the following is not allowed:

   a. Dielectric unions

   b. Triple duty valves

   c. Automatic flow control valves

9. Provide ball valves for shut off on all pressure gauges at the gauge and separate 1/2" (one half inch) ball valves for the various taps to the gauge on a manifold gauge.

10. On chilled water and glycol service use manual vents only. Do not use automatic vent valves.

END OF SECTION

ROOF CURBS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation of roof curbs as shown in Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230550 - Wind Restraint for HVAC Systems.

1.3 SUBMITTALS

A. Typical detail and schedule for equipment. Details shall include cross-sectional view illustrating clearly the type of curb being submitted, i.e. double wall insulated, with or without cant.

PART 2 - PRODUCTS

2.1 ROOF CURBS AND PIPE/DUCT/EQUIPMENT SUPPORTS

A. Basis of Design: Subject to compliance with requirements of this section, provide Roof Products and Systems Corp. (RPS) or comparable product by one of the following:

1. RPI (Roof Products Inc.)

2. ThyCurb

3. Greenheck

B. Configuration: Coordinate curb type with roof deck construction and insulation thickness.

1. Self-flashing without cant strip, with mounting flange (RPS Series 2A).

2. Built-in cant and mounting flange (RPS Series 3A).

3. Built-in raised cant and mounting flange (RPS Series 4A).

C. Provide wind restraint in accordance with specified requirements.

2.2 FAN CURBS/DUCT CURBS

A. Standard Curb:

1. Double wall, 1-1/2 in. minimum thickness, fully insulated in the interior cavity with rigid insulation. Curb constructed of galvanized steel, 1-1/2 in. 3# density insulation with continuous welded corner seams and painted at all welds. 20 gauge up to 36 in., 18 gauge 38 to 72 in., 16 gauge over 72 in. in any dimension.

2. Curb height shall be 24 in. high or as otherwise noted on the drawings.

3. Provide curb with adhesive backed closed cell foam gasket on the top edge to make airtight seal between curb and ventilator, fan, or air handling unit.

B. Basis of Design: RPS - RC Roof Curbs.

2.3 EQUIPMENT SUPPORTS

A. Double wall, minimum 24 in. high. Constructed of 18 gauge galvanized steel with continuous welded corner seams and painted at all welds. Constructed of heavier gauge steel where standard rail cannot support unit weight. Provide with top cap counter flashing. Width to be 5-1/2 inches.

B. Basis of Design: RPS - Equipment Rail ER2.

2.4 DUCT SUPPORTS

A. Double wall, minimum 24 in. high. Constructed of 18 gauge galvanized steel with continuous welded corner seams and painted at all welds. Constructed of heavier gauge steel where standard curb cannot support unit weight. Provide with top cap counter flashing. Width to be 5-1/2 inches.

B. Duct mounting pedestal shall consist of a support rail 12 in. longer than the duct width for single duct support, with a single galvanized steel slide channel equal in length to the equipment rail attached to galvanized steel "U" shaped mounting brackets secured to the side of the equipment rail with lag bolts. The duct mounting slide assembly shall be sized to suit the duct supported and fabricated of galvanized steel and shall have galvanized 18 in. long continuous threaded rods to allow 12 in. vertical adjustment, and lateral adjust spacer bracket for 12 in. horizontal adjustment.

C. Basis of Design: RPS - Duct Mounting Pedestal.

2.5 PIPE SUPPORTS

A. Same construction as "Equipment Supports". Provide with full length galvanized steel bracket, U bolts and accessories as required to secure piping to the pipe support as detailed on Contract Drawings. All fasteners shall be stainless steel.

B. Basis of Design: RPS - Pipe Mounting Pedestal Model ER.

2.6 PIPE CURB ASSEMBLY - SIDE-ENTRY

A. Same construction as "Fan Curbs/Duct Curbs".

B. Insulated, removable sheet metal curb cover, with UV resistant powder coat/paint, and integral counter flashing.

C. Seals to be provided for all penetrations, including but not limited to, electrical conduits, controls conduits, and piping.

1. [ABS compression fitting assembly, EPDM gaskets and threaded cap/backing nut, suitable for pipe sizes 1/4" to 1-5/8" diameter.

a. ABS components: rated for -22°F to 176°F

b. EPDM gaskets: rated for -20°F to 350°F

1) Provide gasket on inner and outer face of curb.

c. Provide 10" extra-long body, field cut to desired length.

d. Basis of Design: Alta Sigrist Exit Seal]

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with manufacturer's written instructions and in accordance with wind restraint requirements.

B. Height as recommended by equipment manufacturer, not less than described in this specification. This Contractor shall be responsible for exact size, length, and location and shall set and secure each curb or support to the roof. Shim and level curb or support as required. Provide curb and supports for all roof-mounted equipment. All roof penetrations shall be made through an appropriate curb. All roof mounted equipment including fans, air handling units, etc, shall be set on an equipment curb or support unless otherwise noted.

END OF SECTION

VIBRATION ISOLATION OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.2 MATERIAL AND EQUIPMENT

A. All vibration isolation mounts shall be supplied by one of the following approved manufacturers:

1.	Mason Industries Inc. (Hauppauge, NY)	M.I.
2.	Kinetics Noise Control Inc. (Dublin, OH)	K.N.C.
3.	Vibration Mountings & Controls Group. (Butler, NJ)	VMC Group
4.	Vibration Eliminator Co. (Long Island City, NY)	V.E.C.

1.3 QUALITY ASSURANCE

A. Coordinate the size, location and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.

C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein even if not expressly specified or shown on the Drawings, without claim for additional payment.

D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specification.

E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for re-balancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

F. Upon completion of work, the Architect or the Architect's Representative shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.

1.4 SUBMITTALS

A. Refer to related sections elsewhere for procedural instruction for submittals.

B. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be completed when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.

C. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.

D. Detailed selection data for each vibration isolator supporting equipment, including:

1. The equipment identification mark.

2. The isolator type.

3. The actual load.

4. The static deflection expected under the actual load.

5. The specified minimum static deflection.

6. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.

7. Special details necessary to convey complete understanding of the work to be performed.

E. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job if requested. All costs associated with submission of samples shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATOR TYPES

A. General:

1. All springs installed out-of-doors shall be zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.

2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.

3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.

4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the Drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type FSN (Floor Spring and Neoprene):

1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, grommets shall be provided for each bolt hole in the base plate. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NO isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, beating plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

2. Type FSN isolators shall be one of the following products with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

a.	Type SLF	M.I.
b.	Type FDS	K.N.C.
c.	Series A	VMC Group

C. Type FSNTL (Floor Spring and Neoprene Travel Limited):

1. Spring isolators shall be freestanding and laterally stable. Spring diameter shall not be less than 0.8 of the compression height of the spring at the rated load. Spring shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one (1). All mounts shall have leveling bolts.

All mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4 in. shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.

2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is use, grommets shall be provided for each bolt hole in the base plate.

3. If the basic spring isolator has a neoprene friction pad on its base and a NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

4. Type FSNTL isolators shall be one of the following products, with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

   a. Type SLR M.I.

   b. Type FLS K.N.C.

   c. Series AWR VMC Group

D. Type FN (Floor Neoprene):

1. Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.

2. Type FN isolators shall be one of the following products or approved equal:

   a. Type ND M.I.

   b. Type RD K.N.C.

   c. Series RD VMC Group

E. Type NP (Neoprene Pad):

1. Neoprene pad isolators shall be one layer of 1/4 in. to 3/8 in. thick ribbed or waffled neoprene. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

2. Type NP isolators shall be one of the following products or approved equal:

a.	Type W	M.I.
b.	Type NPS	K.N.C.
c.	Series Shear Flex	VMC Group

F. Type DNP (Double Neoprene Pad):

1. Neoprene pad isolators shall be formed by two layers of 1/4 in. to 3/8 in. thick ribbed or waffled neoprene, separated by a galvanized steel, stainless steel or aluminum plate. If the isolator is outdoors, the plate shall not be made of galvanized steel. These layers shall be permanently adhered together. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.

2. Type DNP isolators shall be formed from one of the following products or approved equal:

a.	Type WSW	M.I.
b.	Type NPS	K.N.C.
c.	Series Shear Flex	VMC Group

G. Type HSN (Hanger Spring and Neoprene):

1. Vibration isolator hangers shall consist of a free standing and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and hanger housing lower hole size shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the housing. Alternatively, other provisions shall be made to allow for a 30° arc of movement of the bottom hanger rod without contacting the isolator housing. Spring diameter shall not be less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3 in. minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.

2. Type HSN isolators shall be one of the following products or approved equal:

a.	Type 30N	M.I.

b. Type SRH or SFH K.N.C.

c. Type RSH or RFH VMC Group

H. Type HN (Hanger Neoprene):

1. Vibration isolator hangers shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck brushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing.

2. Type HN isolators shall be one of the following products or approved equal:

a. Type HD M.I.

b. Type RH or FH K.N.C.

c. Type RHD or RFD VMC Group

2.2 EQUIPMENT BASES

A. Type BSF (Base-Steel Frame):

1. Steel base frames shall consist of structural steel section sized, spaced, and connected to form a rigid base which will not twist, rack, deform, or deflect in any manner which will negatively affect the operation of the supported equipment or the vibration isolation mounts. Frames shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame shall be at least 1/10 the longest dimension of the base and not less than 6 in. The base footprint shall be large enough to provide stability for supported equipment.

2. Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

3. Type BSF bases shall be supplied by the isolator manufacturer and shall be one of the following products or approved equal:

a. Type WFSL M.I.

b. Type SFB or SRB K.N.C.

c. Series WFB VMC Group

B. Type BIB (Base-Inertia Base):

1. Concrete inertia bases shall be formed of stone-aggregate concrete (150 lb./cu. ft.) and appropriate steel reinforcing cast between welded or bolted perimeter structural steel channels. Inertia bases shall be built to form a rigid base that will not twist, rack, deform, deflect, or crack in any manner that would negatively affect the operation of the supported equipment or the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the inertia base and not less than 6 in. The base footprint shall be large enough to provide stability for supported equipment. Inertia bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

2. The steel frame and reinforcement shall be supplied by the vibration isolator manufacturer.

3. Frame and reinforcement for Type BIB bases shall be one of the following products or approved equal:

a. Type KSL M.I.

b. Type CIB-L or CIB-H K.N.C.

c. Series WPF VMC Group

2.3 RESILIENT PENETRATION SLEEVE/SEAL

A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is 1/2 in. to 3/4 in. larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend 1 in. beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4 in. of the ends of the sleeve. The remaining 1/4 in. space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Refer to details on Drawings.

2.4 RESILIENT LATERAL SUPPORTS

A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN that are specifically designed to provide resilient lateral bracing of ducts or pipe.

B. Resilient lateral supports shall be one of the following products or approved equal:

1. Type ADA M.I.

2. Type RGN K.N.C.

3. Type MDPA VMC Group

2.5 FLEXIBLE DUCT CONNECTIONS

A. Flexible duct connections shall be heavy glass fabric, double neoprene coated, approximately 30 oz. per sq. yd. The clear space between connected parts shall be a minimum of 3 in. and the connection shall have a minimum of 1.5 in. of slack material. Materials for flex connection shall be fire retardant, water and milder resistant, and comply with UL standard 214.

B. Flexible duct connections shall be one of the following products or approved equal:

1. Ventfabrics, Inc. "Ventglass".

2.6 FLEXIBLE PIPE AND PUMP CONNECTIONS (DOUBLE SPHERE)

A. Flexible pipe connections shall be fabricated of multiple plys of nylon cord, fabric, and neoprene; and shall be vulcanized so as to become inseparable and homogeneous. Flexible connections shall be formed in a double sphere shape, and shall be able to accept compressive, elongating, transverse, and angular movements. The flexible connections shall be selected and specifically fitted, if necessary, to suit the system temperature, pressure, and fluid type. In addition, suitable flexible connections should be selected which do not require rods or cables to control extension of the connector.

B. Connectors for pipe sizes 2 in. or smaller shall have threaded female union couplings on each end. Larger sizes shall be fitted with metallic flange couplings.

C. Flexible pipe connections shall be one of the following or approved equal:

1. Type Twin Sphere Metraflex

2. Type MFTNC or MFTFU M.I.

2.7 FLEXIBLE PIPE AND PUMP CONNECTIONS (BRAIDED STAINLESS STEEL)

A. Braided stainless steel pump and pipe connector(s) shall be constructed of annular corrugated stainless steel close-pitch hose with stainless steel overbraid. The corrugated metal hose, braid(s) and a stainless steel ring-ferrule/band (material gauge not less than .048 in.) shall be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. Fittings shall be attached using a 100% circumferential TIG weld.

B. Braided stainless steel pump and pipe connector(s) must be suitable for operating temperatures up to 850°F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor.

C. Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

D. Braided stainless steel connectors shall carry a three (3) year warranty when installed in accordance with all specifications and installation instructions as described by the manufacturer.

E. End fittings shall be flat-faceplate steel flanges with 150# ANSI drilling, and outside diameter, carbon steel MPT ends, flanged by Schedule 40 grooved ends or increasing ends.

F. Acceptable Manufacturers: Flexhose Pumpsaver or equivalent Keflex, Metraflex, Mason-Mercer.

2.8 THRUST RESTRAINTS

A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be pre-compressed at the factory to allow for a maximum of 1/4 in. movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods.

B. Thrust restraints shall be one of the following products or an approved equal:

1.	Type WB	M.I.
2.	Type HSR	K.N.C.
3.	Type HTR	VMC Group

2.9 GROMMETS

A. Grommets shall be specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range.

B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an approved equal:

1.	Type Isogrommets	MBIS, Inc. (Bedford Heights, OH)
2.	Type WB	Barry Controls (Brighton, MA)
3.	Ty	
4.	pe HG	Mason Industries Inc., (Hauppauge, NY)

2.10 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

1.	Acoustical sealant	D.A.P.
2.	BR-96	Pecora
3.	Acoustical sealant	Tremco
4.	Acoustical sealant	U.S.G.

PART 3 - EXECUTION

3.1 APPLICATION

A. General:

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the Drawings or specified herein.

2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment:

1. Unless otherwise shown or specified on Drawings, all floor-mounted major equipment shall be set on 6 in. high concrete housekeeping pads.

2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as specified hereunder.

3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the Drawings.

4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment and as indicated on Drawings in the positions shown on the Drawings.

5. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.

6. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4 in. or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Equipment Vibration Isolation Schedule:

TYPE	VIBRATION ISOLATOR TYPE	MINIMUM STATIC DEFLECTION (In.)	EQUIPMENT BASE
Air Handling Units	DNP	0.30	---
Base Mounted Pumps (Note 1)	FSN	0.75	BIB
Inline Pumps	HSN	0.75	----
Unit Heaters	HSN	0.75	----
Exhaust Fans	HSN	0.75	----
Ceiling Fan Coil Units	HSN	0.75	----

NOTE 1: Equipment base and vibration isolators can be deleted where pumps are provided on slabs on grade and if pumps are placed on concrete inertia slab isolated from surrounding floor slab.

D. Miscellaneous Mechanical Equipment:

1. Miscellaneous pieces of mechanical equipment such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks and expansion tanks which are connected to isolated piping systems shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for .01 in. static deflection) unless their position in the piping system requires a higher degree of isolation as called for under "Pipe Isolation".

E. Pipes:

1. All chilled water, condenser water, hot water, steam main and engine exhaust piping shall be isolated from the building structure within the following limits:

   a. Within mechanical rooms.

   b. Within 50 ft. total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.).

   c. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.

   d. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2 in., Type FSN or Type HSN isolators shall be used. When the required static deflection is less than or equal to 1/2 in., Type FN or Type HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or Type HN achieving at least 1/4 in. static deflection.

   e. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.

   f. Pipes penetrating the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

g. Provide flexible pipe connections as called for under "Major Equipment" above and wherever shown on the Drawings.

3.2 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General:

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.

2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators:

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.

4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.

5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not the floor slab between beams and joists. Provide suitable intermediate support members as necessary.

6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.

7. Parallel running pipes may be hung together on a trapeze, when allowed by Section 232010 that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and un-isolated pipes on the same trapeze.

8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.

9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.

10. The installed and operating heights of equipment vibration-isolated with Type FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4 in. clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases:

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitable rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements, and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

2. Unless otherwise indicated, there is to be a minimum operating clearance of 1 in. between steel rails, steel frame base or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

D. Flexible Duct Connections:

1. Sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so that the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections:

1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.

F. Thrust Restraints:

1. Thrust restraints shall be attached on each side of the fan at the vertical centerline of thrust. The two rods of the thrust restraints shall be parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets:

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals:

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure.
Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION

WIND RESTRAINT FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Support and brace mechanical and electrical systems, as called for, to resist directional wind forces (lateral, longitudinal and vertical).

1.2 APPLICABLE CODES AND STANDARDS

A. Provide work in compliance with the following Codes and Standards based on the current edition in effect at project location:

1. Building Code of New York State (Section 1609 and 1613).

2. Existing Building Code of New York State

3. Mechanical Code of New York State (Section 301, Item 301.15).

4. American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures with Supplement No. 1 - Standard ASCE/SEI 7-16.

1.3 QUALITY ASSURANCE

A. General:

1. The contractor shall provide Professional Engineer stamped and signed engineering calculations and details of wind restraint systems to meet total design lateral force requirements for support and restraint of mechanical systems. Engineer shall be licensed to practice in the state in which the project is located.

2. The wind restraint engineering calculations and details shall provide the quantity of attachments and size/type of attachments for the mounting of an equipment curb or support rail to the building structure, and for attachment of the equipment or system to the equipment curb or support rail. It is not the intent for manufactured equipment curbs or support rails to be certified by their respective manufacturers, nor is it the intent for them to be certified by the Professional Engineer who is providing the wind restraint calculations and connection methodology.

3. Systems requiring wind restraint including, but not limited to:

a. Exhaust fans.
b. Roof curbs and equipment supports associated with any of the equipment listed above.
c. Intake Louvers.

1.4 SUBMITTALS

A. Submit wind force level (Fp) calculations from applicable building code. Submit pre-approved restraint selections, installation details, and plans indicating locations of restraints.

B. Calculations, plans, restraint selection, and installation details shall be stamped and signed by a professionally licensed engineer experienced in wind restraint design.

C. Submit manufacturer's product data.

D. For each piece of equipment that requires wind restraint as outlined in this section, include the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchoring provisions.

2. Anchorage: Provide detailed description of equipment anchorage devices on which the calculations are based and their installation requirements. Identify anchor bolts, studs and other mounting devices. Provide information on the size, type and spacing of mounting brackets, holes and other provisions.

E. The Contractor shall provide photographs of the installed roof mounted equipment, showing the fully installed wind restraint anchoring, prior to the roofing material installation, as a formal submittal for verification that the work has been completed.

PART 2 - PRODUCTS

2.1 CODE INFORMATION

A. This project is subject to the wind bracing requirements of the codes listed above. The following criteria are applicable to this project:

1. Ultimate Design Wind Speed (V): 110 mph

2. Risk Category: II

3. Exposure Category: C

4. Ground Elevation Factor (Ke): 0.97

5. Topographic Factor (Kzt): 1.0

6. Wind Directionality Factor (Kd): 0.85

7. Combined Gust Factor for Rooftop Equipment (GCr): Per Section 29.4.1 of ASCE 7-2016, based on dimensions of individual rooftop equipment considered.

8. Height and Exposure Adjustment Coefficient (λ): 1.35

2.2 WIND BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Design analysis shall include calculated dead loads, wind loads, and capacity of materials utilized for the connection of the equipment or system to the structure.

2. Analysis shall detail anchoring methods, fastener sizes and spacing, etc.

3. All wind restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 2.1.

B. Friction from gravity loads shall not be considered resistance to wind forces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wind Restraint of Piping:

1. All restraint systems shall be installed in strict accordance with the wind restraint design submittal.

2. Installation of restraints shall not cause any change in position of equipment or piping, resulting in stress or misalignment.

B. Wind Restraint of Ductwork and Equipment:

1. All restraint systems shall be installed in strict accordance with the wind restraint design submittal.

2. The interaction between mechanical and electrical equipment and the supporting structures shall be designed into the restraint systems.

3. Installation of restraints shall not cause any change in position of equipment or ductwork, resulting in stress or misalignment.

4. Exhaust fans with hinge kits shall have wind restraint fasteners installed on the hinged side, same as the three (3) non-hinged sides.

5. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

6. Do not install any equipment or duct that makes rigid connections with the building unless isolation is not specified.

7. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

3.2 INSPECTION

A. The engineer who performs the delegated design for wind restraint shall inspect photos provided by the installing contractor to verify that the installation is in accordance with their design and applicable codes. The delegated design engineer shall coordinate with the contractor(s) who have installed the work.

B. Upon final acceptance by the delegated design engineer of all work performed by the contractor(s), the delegated design engineer shall submit a letter to the Owner's Representative indicating that the installation of restraints complies with the requirements of their design and applicable codes.

END OF SECTION

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATION

A. All identification devices shall comply with ANSI/ASME A13.1 for lettering size, length of color field, colors, directional arrow and viewing angles.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for each identification material and device.

B. Submit valve schedule for each piping system indicating valve number, location, and valve function.

C. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

D. Submit system schematic diagram with location of valve and associated valve number.

1.4 MAKES

A. Allen Systems, Inc.; Brady (W.H.) Co.; Signmark Div.; Industrial Safety Supply Co., Inc.; Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide manufacturer's standard products of categories and types required for each application. In cases where this is more than one type specified for an application, selection is installer's option but provide single selection for each product category.

B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 PIPING IDENTIFICATION

A. Identification Types:

1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI/ASME A13.1.

a. Provide a 360° wrap of flow arrow tape at each end of pipe label.

O.D. Pipe or Covering	Length of Color Field	Letter Size
3/4 in. to 1-1/4 in.	8 in.	1/2 in.
1-1/2 in., 2 in.	8 in.	3/4 in.
2-1/2 in. to 6 in.	12 in.	1 1/2 in.
8 in. to 10 in.	24 in.	2 1/2 in.
Over 10 in.	32 in.	3 1/2 in.

B. Colors:

Fluid Service	Colors & Letters Description
Potable, Cooling, Boiler Feed, Other Water	GREEN (White Letters)

C. Lettering:

1. Piping labeling shall conform to the following list:

Pipe Function	Identification
Heating Water Supply	HWS
Heating Water Return	HWR
Chilled Water Supply	CWS
Chilled Water Return	CWR
Glycol Supply	GS
Glycol Return	GR

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high numerals. Identify between heating and plumbing services with 1/4 in. letters above the valve number. Lettering to be stamped and in-filled black. Seton, or equal.

a. Valve-tag Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Chart:

1. Provide valve chart for all valves tagged as a part of this project. Frame and place under clear glass. Hang in Mechanical Room.

2. Valve chart to include as a minimum, valve #, valve size, valve type, valve service description, valve location.

2.4 EQUIPMENT LABELS

A. Metal Labels for Equipment (Indoors):

1. Material and Thickness: Brass, 0.032 in. minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 in. by 3/4 in.

3. Minimum Letter Size: 1/4 in. for name of units if viewing distance is less than 24 in., 1/2 in. for viewing distances up to 72 in. and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment (Indoors):

1. Material and Thickness: Multilayer, multicolor, phenolic (micarta) labels for mechanical engraving, 1/8 in. thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 in. by 3/4 in.

6. Minimum Letter Size: 1/4 in. for name of units if viewing distance is less than 24 in., 1/2 in. for viewing distances up to 72 in., and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 in. x 11 in. bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

E. Provide for the following equipment:

1. Air handling units

2. Fans

3. Pumps

4. Fan Coil Units

5. Variable Volume Air Terminal Units

2.5 ABOVE CEILING EQUIPMENT LOCATOR

A. 3/4 in. diameter adhesive stickers placed on ceiling grid. Color coded. Provide for the following:

1. Fire dampers/smoke dampers - RED

2. Plumbing valves - BLUE

3. HVAC valves - ORANGE

4. Air Valves, VAV boxes or reheat coils - GREEN

5. Fans - YELLOW

6. Pumps - BLACK

PART 3 - EXECUTION

3.1 GENERAL

A. Provide piping identification with directional flow arrows for all piping on project, at maximum intervals of 20 ft.

1. For piping installed through floors or walls, provide at least one pipe label on each side of penetration, for each pipe function.

2. For piping adjacent to 3-way diverting/mixing valves and tee/wye branches, provide at least one pipe label on each side of valve/tee.

3. Label all abandoned piping if abandoned piping is allowed by Owner/Engineer. Document locations of all abandoned piping on as-builts.

B. Provide valve tags for all valves provided on project, except for service valves at terminal equipment.

C. Provide equipment tags for all equipment listed above.

D. Provide above ceiling equipment locator stickers on ceiling grid for all equipment listed above.

END OF SECTION

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

B. This Section specifies the requirements and procedures of mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

C. Test, adjust, and balance the following mechanical systems:

1. Airside

a. Supply air systems, all pressure ranges; including constant volume and variable volume systems.

b. Return air systems.

c. Exhaust air systems**.**

2. Hydronics

a. Constant flow systems.

b. Variable flow systems.

D. This Section does not include:

1. Testing boilers and pressure vessels for compliance with safety codes.

2. Specifications for materials for patching mechanical systems.

3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.

4. Requirements and procedures for piping and ductwork systems leakage tests.

1.2 SUBMITTALS

A. Provide information in report form listing items required by specifications. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner’s Representative.

B. Strategies and Procedures Plan: Within thirty (30) days of Contractor's Notice to Proceed, submit testing and balancing strategies and step-by-step procedures as specified in Section 3.1.B, "Preparation", and consistent with those listed in Part 3 of this specification.

C. System Readiness Checklists: Within thirty (30) days of Contractor's Notice to Proceed, AABC agency shall provide system readiness checklists as specified in Section 3.1.C, "Preparation", to be used and filled out by the installing contractors verifying that systems are ready for Testing and Balancing.

D. Examination Report: Provide a summary report of the examination review required in Section 3.1.D to the Engineer, documenting issues that may preclude the proper testing and balancing of the systems.

E. Certified report format shall consist of the following:

1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

2. Individual test sheets for air handlers, terminal units, air distribution, exhaust fans, duct traverses, pumps, air handling coils, reheat coils, radiation, convectors, cabinet unit heaters and unit ventilators.

3. Manufacturer's pump and fan curves for equipment installed with design and actual operating conditions indicated.

4. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TABB's "Testing, Adjusting and Balancing Bureau".

1.3 DEFINITIONS

A. System testing, adjusting and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:

1. The balance of air and water distribution;

2. Adjustment of total system to provide design quantities;

3. Electrical measurement;

4. Verification of performance of all equipment and automatic controls.

B. Test: To determine quantitative performance of equipment.

C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

F. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. This data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

G. Terminal: The point where the controlled fluid enters or leaves the distribution system. There are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return supply or outside air inlets or outlets on terminals such as registers, grilles, diffusers, and louvers.

H. Main: Duct or pipe containing the system's major or entire fluid flow.

I. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.

J. Branch Main: Duct or pipe serving two or more terminals.

K. Branch: Duct or pipe serving a single terminal.

1.4 QUALIFICATIONS

A. Follow procedures and methods published by one or more of the following:

1. Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) or Testing, Adjusting and Balancing Bureau (TABB).

2. Individual manufacturer requirements and recommendations.

B. Maintain qualified personnel at project for system operation and trouble shooting. TAB contractor shall change sheaves and perform mechanical adjustments in conjunction with balancing procedure.

C. Balancing contractor shall be current member of AABC, NEBB, or TABB.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the *AABC National Standards for Total System Balance and SMACNA TAB Procedural Guide.*

1.5 GENERAL REQUIREMENTS

A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balance facilities.

B. Place systems in satisfactory operating condition.

1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.

2. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

3. All outdoor conditions (Db, Wb, and a description of the weather conditions) at the time of testing shall be documented in the report.

4. Airside

   a. Prior to balancing, adjust balancing devices for full flow and replace temporary filters.

   b. Provide sheaves and belts as required to meet system performance requirements for all belt-driven fan motors 10 HP and greater. Adjust and align sheaves to obtain proper settings and operation. Verify motors are not overloading.

   c. Installing contractor shall replace dampers in new systems and identify dampers in existing systems that cannot be manipulated to satisfy balancing requirements.

   d. Traverse main ducts to determine total system air quantities after all outlets have been set prior to final adjustment if the system does not meet design requirements. A sum of room CFM's is not acceptable.

   e. If duct construction and/or installation prohibits proper traverse readings, provide coil measurements at main coils and/or fresh air intake traverse with units operating in 100% outside air mode (where applicable).

5. Hydronics

   a. Prior to balancing, adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.

   b. Installing contractor shall replace balancing cocks and flow balancers in new systems and identify flow balancers and balancing cocks in existing systems that cannot be manipulated to satisfy balancing requirements.

1.6 CONTRACTOR RESPONSIBILITIES

A. Provide Testing and Balancing agency one complete set of contract documents, change orders, and approved submittals in digital and hard copy formats.

B. Controls contractor shall provide required BAS hardware, software, personnel and assistance to Testing and Balancing agency as required to balance the systems. Controls Contractor shall also provide trending report to demonstrate that systems are complete.

C. Coordinate meetings and assistance from suppliers and contractors as required by Testing and Balancing agency.

D. Installing contractor shall replace or repair insulation as required by Testing and Balancing agency.

E. Have the HVAC systems at complete operational readiness for Testing and Balancing to begin. As a minimum verify the following:

1. Airside:

a. Provide additional dampers, sheaves and belts as required by Testing and Balancing agency.

b. Flag all manual volume dampers with fluorescent or other high-visibility tape.

c. Provide access to all dampers, test ports, nameplates and other appurtenances as required by Testing and Balancing agency.

d. All ductwork is complete with all terminals installed.

e. All volume, smoke and fire dampers are open and functional.

f. Clean filters are installed.

g. All fans are operating, free of vibration, and rotating in correct direction.

h. ASD start-up is complete and all safeties are verified.

i. System readiness checklists are completed and returned to Testing and Balancing agency.

2. Hydronics:

a. Provide additional valves as required by Testing and Balancing agency.

b. Provide access to all valves, test ports, nameplates and other appurtenances as required by Testing and Balancing agency.

c. Piping is complete with all terminals installed.

d. Water treatment is complete.

e. Systems are flushed, filled and air purged.

f. Strainers are pulled and cleaned.

g. Control valves are functioning per the sequence of operation.

h. All shutoff and balance valves have been verified to be 100% open.

i. Pumps are started, and proper rotation is verified.

j. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.

k. ASD start-up is complete and all safeties have been verified.

l. System readiness checklists are completed and returned to Testing and Balancing agency.

F. Promptly correct deficiencies identified during Testing and Balancing.

G. Maintain a construction schedule that allows the Testing and Balancing agency to complete work prior to occupancy.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, Pitot tubes, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required.

B. Instrumentation Calibration: Calibrate instruments at least every six (6) months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine Bid Documents and submittals and notify Owner's Representative and Engineer of any questions regarding balancing.

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper Testing and Balancing of systems and equipment.

2. Examine the approved submittals for HVAC systems and equipment.

3. Examine equipment performance data including fan and pump curves.

B. Prepare a Testing and Balancing Strategies and Procedures Plan that includes:

1. Equipment and systems to be tested.

2. Strategies and step-by-step procedures for balancing the systems.

3. Instrumentation to be used.

4. Sample forms with specific identification for all equipment.

C. Prepare system-readiness checklists, as described in the *AABC National Standards for Total System Balance and SMACNA TAB Procedural Guide*, for use by contractors in verifying system readiness for Testing and Balancing. These shall include, at a minimum:

1. Airside:

   a. All ductwork is complete with all terminals installed.

   b. All volume, smoke and fire dampers are open and functional.

   c. Clean filters are installed.

   d. All fans are operating, free of vibration, and rotating in correct direction.

   e. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.

   f. Automatic temperature-control systems are operational.

   g. Ceilings are installed.

   h. Windows and doors are installed.

   i. Suitable access to balancing devices and equipment is provided.

   j. Equipment and duct access doors are securely closed.

2. Hydronics:

   a. Piping is complete with all terminals installed.

   b. Water treatment is complete.

   c. Systems are flushed, filled and air purged.

   d. Strainers are pulled and cleaned.

   e. Control valves are functioning per the sequence of operation.

   f. All shutoff and balance valves have been verified to be 100% open.

   g. Pumps are started and proper rotation is verified.

   h. Pump gauge connections are installed directly at the pump inlet and outlet flange or in discharge and suction pipe prior to any valves or strainers.

   i. Permanent electrical power wiring and ASD start-up is complete and all safeties are verified.

j. Suitable access to balancing devices and equipment is provided.

D. Examine construction and notify Owner's Representative and Engineer of outstanding issues related to balancing, as part of "Examination Report" submittal.

1. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.

2. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor and functioning.

3. Airside

a. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.

b. Examine systems for installed balancing devices, such as test ports, gage cocks, flow-control devices, and manual volume dampers prior to pressure testing. Note the locations of devices that are not accessible for testing and balancing.

4. Hydronics

a. Examine strainers to verify that Mechanical Contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.

b. Examine two-way valves for proper installation and function.

c. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

d. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

e. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

f. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings and weld-o-lets prior to pressure testing. Note the locations of devices that are not accessible for testing and balancing.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TABB's "SMACNA TAB Procedural Guide" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.

a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to sheaves sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.4 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return-and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure.
Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

   a. If air outlets are out of balance at minimum airflow, report the conditions but leave outlets balanced for maximum airflow.

6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that the adequate static pressure is maintained at the most critical unit.

8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

3.5 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Cross check the summation of required coil and heat exchanger gpms with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:

1. Check liquid level in expansion tank and verify that tank is set to specified pressure for system fill and expansion.

2. Check that makeup water has adequate pressure to highest vent.

3. Check that control valves are in their proper positions.

4. Check that air has been purged from the system.

5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

6. Verify that motor starters are equipped with properly sized thermal protection.

3.6 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.

b. Measure flow by main flow meter, if installed.

c. If main flow meter is not installed, determine flow by pump total dynamic head (TDH) or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves or fittings.

b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.

c. Convert pressure to head and correct for differences in gauge heights.

d. On single stage centrifugal pumps, verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

e. With all valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.

2. Adjust main and branch balance valves for design flow.

3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow measuring devices installed at terminals for each space to design water flows.

1. Measure flow at all terminals.

2. Adjust each terminal to design flow.

3. Re-measure each terminal after all have been adjusted.

4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.

5. Perform temperature tests after all flows have been balanced.

D. For systems with pressure-independent valves at the terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.

2. Perform temperature tests after all flows have been verified.

E. For systems without pressure-independent valves or flow measuring devices at the terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.

2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.

2. Re-measure all final pump operating data, TDH, volts, amps, static profile.

3. Mark all final settings.

G. Verify that all memory stops have been set.

3.7 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Adjust the variable-flow hydronic system as follows:

1. Verify that the differential pressure (DP) sensor is located per the Contract Documents.

2. Determine if there is diversity in the system.

B. For systems with no diversity:

1. Follow procedures outlined for constant-flow hydronic systems.

2. Prior to verifying final system conditions, determine the system DP setpoint.

3. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.

4. Mark all final settings and verify that all memory stops have been set.

C. For systems with diversity:

1. Determine diversity factor.

2. Simulate system diversity by closing required number of control valves, as approved by the design Engineer.

3. Follow procedures outlined for constant flow hydronic systems.

4. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance the terminals that were just opened.

5. Prior to verifying final system conditions, determine the system DP setpoint.

6. If the pump discharge valve was used to set total system flow with ASD at 60 Hz, at completion open discharge valve 100% and allow ASD to control system DP setpoint. Record pump data under both conditions.

7. Mark all final settings and verify that all memory stops have been set.

D. For systems with pressure-independent valves at the terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.

2. Perform temperature tests after all flows have been verified.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Zero to plus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

3. Minimum Outside Air: Zero to plus 10 percent.

4. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

5. Heating-Water Flow Rate: Plus or minus 10 percent.

6. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.9 FINAL TEST & BALANCE REPORT

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the Testing and Balancing process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel.
All measurements and test results that appear in the reports must be made on site and dated by the technicians or Test and Balance Engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:

a. AABC or NEBB Certified Company Name.

b. Company Address.

c. Company Telephone Number.

d. Project Identification Number.

e. Location.

f. Project Architect.

g. Project Engineer.

h. Project Contractor.

i. Project Number.

j. Date of Report.

k. Certification Statement.

l. Name, Signature, and Certification Number.

2. Table of Contents.

3. National Performance Guaranty.

4. Report Summary:

   a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.

5. Instrument List:

   a. Type
   b. Manufacturer
   c. Model
   d. Serial Number
   e. Calibration Date

C. Required Airside data - Test, adjust and record the following:

1. Motors:

   a. RPM
   b. BHP
   c. Full load amps
   d. Sheave sizes, number and size of belts
   e. Shaft diameter
   f. Complete nameplate data

2. Fans:

   a. Cfm
   b. RPM
   c. Suction static pressure
   d. Discharge static pressure
   e. Sheave sizes, number and size of belts, key sizes, shaft, diameter
   f. Complete nameplate data
   g. Sketch of system's inlet and outlet connections
   h. Location of test port

3. Duct: Traverse Zones:

   a. Cfm
   b. Static Pressure

4. AHU – Air handling units, Fan coil units (In both minimum O.A. and economizer modes):

   a. Minimum outdoor air Cfm
   b. Total discharge and return Cfm
   c. Static profile thru unit
   d. Complete nameplate data

5. Coil:

    a. Entering air temperature (DB/WB)
    b. Leaving air temperature (DB/WB)
    c. Static differential
    d. Face velocity and area
    e. Cfm
    f. Complete nameplate data

6. VAV Boxes:

    a. Minimum Cfm
    b. Maximum Cfm

7. Registers/Grilles/Diffusers:

    a. Cfm
    b. Set, adjust and record air flow pattern

8. Filter Banks:

    a. Nameplate data
    b. Static pressure drop

D. Required Fluid Data: Test, adjust and record the following:

1. Heat Transfer Devices: Including, but not limited to air handlers, convectors, fin tube radiation sections, unit ventilators, fan coils, cabinet heaters, unit heaters, heat pumps, heat exchangers.

    a. GPM (coil and bypass)
    b. Entering water temperature
    c. Leaving water temperature
    d. Water pressure drop
    e. Complete nameplate data

2. Pumps:

    a. Check rotation
    b. GPM
    c. Pump off pressures (suction and discharge)
    d. Running suction pressure
    e. Running discharge pressure
    f. Running load amps
    g. RPM - motor
    h. Complete nameplate motor and pump
    i. Marked up pump curve illustrating final operating conditions

3. Heat Exchanger:

    a. GPM

b. Entering water temperature and pressure
c. Leaving water temperature and pressure
d. Complete nameplate data

E. The final test and balance report shall be provided as a formal project submittal for review by the Engineer of Record.

END OF SECTION

INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

A. Submit product data, product description, manufacturer's installation instructions.

B. Submit schedule of types and thicknesses for each application, and location of materials.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 232010 - Piping Systems and Accessories.

B. Section 233100 - Sheet Metal and Ductwork Accessories Construction.

PART 2 - PRODUCTS

2.1 GENERAL

A. See Exhibits at the end of this section for where insulating materials shall be applied, thickness, jacketing and remarks.

B. Provide work in compliance with the following Codes and Standards based on the current edition in effect at project location:

1. Energy Conservation Code of New York State.

C. Insulation, jackets, adhesive, and coatings shall comply with the following:

1. Products shall not contain asbestos, lead, mercury, or mercury compounds.

2. Insulation, including jackets, finishes and adhesives on the exterior surfaces of ducts, pipes, and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723.

a. Plenums: Insulation materials shall be noncombustible or listed and labeled per ASTM E84 or UL 723.

b. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments are not permitted.

3. All adhesives, coatings and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

4. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.

5. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

6. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C 871.

7. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C 795.

2.2 ACCEPTABLE MANUFACTURERS

A. Flexible Elastomeric: Armacell AP ArmaFlex/FS (Indoor: AP ArmaFlex up to 1", FS 1-1/2" to 2"; Outdoor: All sizes), Aeroflex (Indoors/Outdoors: All sizes), K-Flex Insul-Lock (Indoors: All sizes), K-Flex Titan (Indoors: Up to 1-1/2"; Indoors/Outdoors: All sizes), or approved equal.

B. Fiberglass: Johns Manville, Knauf/Manson, Owen-Corning, or approved equal.

C. Polyisocyanurate: Johns Manville Trymer 25-50 PIR (Indoors), 2000XP (Outdoors), HiTherm, or approved equal.

D. Jacketing: Johns Manville (PVC) or approved equal.

E. Adhesives, Coatings, Mastics, Sealants: Childers, Foster, or approved equal.

2.2 FLEXIBLE ELASTOMERIC

A. Closed-cellular, sponge or expanded-rubber with integral vapor barrier.

B. Tube and Sheet:

1. Product meeting ASTM C 534, Type I/II Grade 1.

2. 'K' Value at 75°F mean temperature

a. 0.245 BTU-in/ft^2 hr. °F (up to 1 in. wall thickness).

b. 0.28 BTU-in/ft^2 hr. °F (1-1/2 in. to 2 in. wall thickness).

C. Sheet:

1. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.3 FLEXIBLE FIBERGLASS

A. Glass fibers bonded with a resin.

B. Blanket:

1. Product meeting ASTM C 553 Types I, II and III, and ASTM C 1290; Greenguard compliant.

2. 'K' Value: 0.27 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Maximum Service Temperature (Faced): 250°F.

4. Vapor Retarder Jacket: FSK conforming to ASTM C 1136 Type II.

5. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.4 RIGID FIBERGLASS

A. Pre-formed glass fibers bonded with a thermosetting resin.

B. Pipe:

1. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.

2. 'K' Value: 0.23 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Maximum Service Temperature: 1000°F.

4. Vapor Retarder Jacket: Factory applied ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

5. Field applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV resistant fittings, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures to be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

C. Board:

1. Product meeting ASTM C 612 Type IA and IB. Maximum Service Temperature: 450º F.

2. 'K' Value: 0.24 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Vapor Retarder Jacket:

a. ASJ conforming to ASTM C 1136 Type I

b. FSK or PSK conforming to ASTM C 1136 Type II.

4. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.5 RIGID POLYISOCYANURATE

A. Pre-formed closed-cellular foam, rigid molded.

B. Pipe:

1. Product meeting ASTM C591, rigid molded, noncombustible.

2. 'K' Value: 0.19 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Maximum Service Temperature: 300°F.

4. Vapor Retarder Jacket: Dow Saranex Vapor Retarder Film and Tape.

5. Fittings shall match pipe requirements.

C. Board:

1. Product meeting ASTM C1289 Type I, Class I.

2. "K" value: 0.17 BTU-in/ft^2 hr. °F at 75°F mean temperature.

3. Density: As required to meet specified R-value in Exhibit, unless otherwise noted.

2.6 FIELD APPLIED JACKETS

A. PVC: High-impact UV resistant PVC; roll stock ready for shop or field cutting and forming.

1. Thickness: 30 mil.

2. PVC Jacket Color: White.

2.7 ADHESIVES, COATINGS, MASTICS, SEALANTS

A. Provide per manufacturer product requirements for associated system and application/installation location.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All materials shall be installed by skilled labor regularly engaged in this type of work and installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system per manufacturer requirements. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air. Install insulation with longitudinal seams at top and bottom of horizontal runs. Install multiple layers of insulation with longitudinal and end seams staggered and with the least number of joints possible.

C. All pipe and duct insulation shall be continuous through hangers.

D. Provide thermal insulation on clean, dry surfaces and after piping, ductwork and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.

E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.

F. Items such as boiler manholes, handholds, clean-outs, ASME stamp, and manufacturers' nameplates, may be left uninsulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.

G. Provide protective insulation as required to prevent personnel injury: Piping from zero to seven feet above all floors and access platforms including hot (above 140°F) piping and any other related hot surface.

H. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.

I. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

J. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

K. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

3.2 PENETRATIONS

A. Aboveground Exterior Wall: Install insulation continuously through penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above through surface and seal with joint sealant.

B. Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Interior Floor, Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Fire-Rated Floor, Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.3 PIPE INSULATION

A. All pipes shall be individually insulated. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system.

B. Piping insulation is allowed to be reduced in thickness only when a specific UL assembly detail for piping passing thru a rated wall indicates a maximum insulation thickness that is less than this specification section calls for. In this case reduce the insulation thickness just for the rated wall penetration. The reduction of insulation thickness shall be limited to the length of the penetration only.

C. Coordinate insulation installation requirements for heat tracing that may apply.

3.4 DUCTWORK INSULATION

A. Provide external thermal insulation for ductwork. Not required where ducts have internal acoustical insulation. Make special provisions at dampers, damper motors, thermometers, instruments, and access doors.

B. Provide factory ASJ jacket for ductwork required to be insulated and to be painted.

3.5 EQUIPMENT INSULATION

A. Apply insulation with joints firmly butted as close as possible to the equipment surface.

EXHIBIT "I" - PIPE INSULATION MATERIALS

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Hot water and glycol/hot water (up to 200°F)	Rigid Fiberglass	1-1/2 in. and Larger: 2 in. 1-1/4 in. and Smaller: 1-1/2 in.	
Low temperature hot water (up to 140°F)	Rigid Fiberglass	1-1/2 in. and Larger: 1-1/2 in. 1-1/4 in. and Smaller: 1 in.	
Chilled water (temperature greater than 40°F)	Rigid Fiberglass or Rigid Polyisocyanurate	1-1/2 in. and Larger: 1 in. 1-1/4 in. and Smaller: 1/2 in.	Refer to Note 3 for locations with Rigid Polyisocyanurate.
AC unit condensate drains	Rigid Fiberglass	All Sizes: 1 in.	

NOTES FOR EXHIBIT "I":

NOTE 1: Use cork insulation tape equal to K-flex Cork Tape for cold service piping where installed inside equipment valve compartment (fan coil, etc.).

NOTE 2: Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing shall be insulated with double the thickness called for the associated service.

NOTE 3: All interior exposed piping below ceilings and above finished floor in occupied spaces shall be insulated with rigid polyisocyanurate insulation (for cold services) and rigid fiberglass (for hot services) with rigid fiberglass fittings and PVC jacket.

NOTE 4: All interior exposed piping, valves, fittings, and specialties less than 8'-0" above finished floor in mechanical/electrical rooms shall be jacketed with PVC.

EXHIBIT "II" - DUCT INSULATION MATERIALS

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Supply (concealed)	Flexible Fiberglass	2 in.	Min. installed R value of 6
Supply (within mechanical rooms or exposed at 8'-0" or less above finished floor)	Rigid Fiberglass	1-1/2 in.	Min. installed R value of 6
Outside air ducts and plenums, connections and mixing boxes	Rigid Fiberglass	2 in.	Min. installed R value of 8
Neutral ventilation air supply ducts (between 65°F and 80°F)	Not insulated	Not insulated	
Return and exhaust within heated building envelope	Not insulated	Not insulated	
Exhaust, relief or vent ducts and plenums (concealed)	Flexible Fiberglass	2 in.	Min. installed R value of 6 Insulate ducts 15 ft. from exterior opening and plenums.
Exhaust, relief or vent ducts and plenums (exposed)	Rigid Fiberglass	1-1/2 in.	Min. installed R value of 6 Insulate ducts 15 ft. from exterior opening and plenums.

EXHIBIT "III" - EQUIPMENT INSULATION MATERIALS

SERVICE	INSULATION MATERIAL	THICKNESS	REMARKS
Filter assembly housings and sound attenuators when factory un-insulated	Rigid Fiberglass	Same as associated ductwork	
Air removal assemblies and fabric filter assemblies		Same as water piping	
Heating system expansion tanks and chemical feed tanks	Not insulated	Not insulated	
Chilled water pumps	Flexible Elastomeric	1 in.	
Cooling system expansion tanks and chemical feed tanks		Same as water piping	

NOTES FOR EXHIBIT "III":

NOTE 1: Insulate any cold surfaces subject to condensation that have not been factory insulated.

END OF SECTION

SECTION 230800

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. The OPR and BOD documentation are included by reference for information only.

C. Division 01 section 'LEED Requirements' for additional LEED requirements.

1.2 SUMMARY

A. This section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

A. Refer to Division 01 Section "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.

B. Refer to Division 01 Section "Submittals" for specific requirements. In addition, provide the following:

C. Certificates of readiness

D. Certificates of completion of installation, prestart, and startup activities.

E. O&M manuals

F. Test reports

1.6 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.

1.7 COORDINATION

A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - 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&R system and controls system in Division 23, except for equipment specific to and used by 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 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.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems

B. 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 made available to the Commissioning Team for use prior to the start of 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.

C. 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 mad by the Contractor.

D. 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 four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meetings.

C. Attend testing, adjusting, and balancing review and coordination meetings.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

G. Prepare preliminary schedule for Mechanical system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.

H. Update schedule as required throughout the construction period.

I. Assist the CxA in all verification and functional performance tests.

J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

K. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.

L. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

M. Notify the CxA a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.

N. Participate in, and schedule vendors and contractors to participate in the training sessions.

O. Provide written notification to the CM/GC and CxA Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
   1. HVAC&R equipment including all fans, air handling units, ductwork, dampers, terminals, and all other equipment furnished under this Division.
   2. Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
   3. Fire detection and smoke detection devices furnished under other divisions of the specification.

P. The equipment supplier shall document the performance of his equipment.

Q. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.

R. Test, Adjust and Balance Contractor
   1. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
   2. Submit the site specific testing and balancing plan to the CxA and AE for review and acceptance.
   3. Attend the testing and balancing review meeting scheduled by the CxA. Be prepared to discuss the procedures that shall be followed in testing, adjusting, and balancing the HVAC&R system.
   4. At the completion of the testing and balancing work, and the submittal of the final testing and balancing report, notify the HVAC&R contractor and the CM/GC.
   5. At the completion of testing and balancing work, and the submittal of the final testing and balancing report, notify the HVAC&R Contractor and the CM/GC.
   6. Participate in verification of the testing and balancing report, which will consist of repeating measurements contained in the testing and balancing reports. Assist in diagnostic purposes when directed.

S. Equipment Suppliers
   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 contractors.
   3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

T. Refer to Division 01 Section “General Commissioning Requirements” for additional contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for Owner's Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for Design Professional's Responsibilities.

3.5 CxA'S RESPONSIBILITIES

A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.6 TESTING PREPARATION

A. Certify in writing to the CxA that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.7 TESTING, ADJUSTING AND BALANCING VERIFICATION

A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.8 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.9 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 23 sections. Provide submittals, test data, inspector record, and certifications to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

F. Vibration and Sound Tests**:** Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

G. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

1. Ductwork
2. Air Handlers
3. Terminal Equipment (VAVs, Fan Coil Units, Etc.)
4. Exhaust Fans
5. Chilled Water Pumps
6. Heat Exchangers
7. Heating Water Pumps
8. Snowmelt Zones
9. Snowmelt Pumps
10. BMS

3.10 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.11 APPROVAL

A. Refer to Division 01 Section “General Commissioning Requirements” for approval procedures.

3.12 DEFERRED TESTING

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.13 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.

B. Refer to Division 01 Section “General Commissioning Requirements” for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.14 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to training.

END OF SECTION 230800

BUILDING AUTOMATION CONTROL SYSTEM COMMUNICATIONS

PART 1 - GENERAL

1.1 INTRODUCTION

A. Building automation and direct digital control systems throughout Cornell require integration to the campus Energy Management and Control System (EMCS). To ensure compatibility, all installations of digital building automation and control equipment shall support communications via the BACnet standard, ANSI/ASHRAE Standard 135-2012, BACnet® - A Data Communication Protocol for Building Automation and Control Networks and the related international standard, ISO 16484- 5.

1.2 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation of the Building Automation Control System (BACS) designed in Contract Drawings and described in Section 230923. The Building Automation Control System (BACS) to perform the communication and interoperability requirements as described in this Section.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230923 – Building Automation Control System.

1.4 APPLICABLE STANDARDS

A. The following standards shall govern the design and selection of equipment supplied to fulfill the requirements of this section:

1. ANSI/ASHRAE Standard 135-2012: *BACnet®. - A Data Communication Protocol for Building Automation and Control Networks*, as amended, and hereinafter referred to as "BACnet". American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 2012.

2. ATA/ANSI 878.1 (1992), ARCNET Local Area Network.

3. ISO/IEC 8802-3 (1993), Information processing systems - Local area networks - Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

1.5 DEFINITIONS

A. In addition to the definitions contained in the applicable standards, the following should be noted:

1. ARCNET: Attached Resource Computer Network. See BACnet, Clause 8 and ATA/ANSI 878.1.

2. BACnet/IP: BACnet Annex J Devices. Annex J of BACnet describes how BACnet devices can make use of IP directly for communicating across IP-based internets.

3. BACnet PICS; A Protocol Implementation Conformance Statement that describes the BACnet capabilities of a specific device. See BACnet, Annex A.

4. BACS: Building Automation and Control System.

5. BACSI: The Building Automation and Control Systems Integration group within the Cornell Facilities and Campus Services organization. BACSI is responsible for the EMCS and the coordination of BACS device addressing and network numbering.

6. BBMD: BACnet Broadcast Management Device. See BACnet, Annex J.

7. BI: BACnet International. The trade association responsible for the worldwide promotion of BACnet.

8. BIBB: BACnet Interoperability Building Block. A collection of one or more BACnet services defined for the purpose of describing communication functionality in an unambiguous way. See BACnet, Annex K.

9. BTL: The BACnet Testing Laboratories of BI. The organization responsible for testing products to assure that they conform to the BACnet standard. Listings of tested products are available at www.bacnetassociation.org.

10. Campus Backbone: A fiber optic data communication infrastructure on the Cornell campus managed by CIT. Users connect to the backbone by means of CIT-supplied Ethernet switches in each building and appropriate 10/100/1000BASE-T unshielded, twisted pair wiring. The backbone uses IP for routing messages to and from computers both on and off the Cornell campus.

11. CIT: Cornell Information Technologies. The organization that manages the Cornell campus networking infrastructure, including the provision of network connections in Cornell buildings.

12. Device Profile: A collection of BIBBs that describes the minimum BACnet capabilities of a particular device in order to achieve reliable communication in one of five specified "interoperability areas." Devices include BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC) and BACnet Application Specific Controllers (B-ASC). See BACnet, Annex L.

13. EMCS: A computer complex that provides Energy Management and Control System functions for the University. The EMCS is connected to the campus backbone and uses IP for the routing of messages to and from individual buildings, and allows 24/7 monitoring of BACS alarms. The EMCS also provides other infrastructure monitoring and control functions for campus utilities and CIT's network operations.

14. Ethernet: A carrier sensing multiple access with collision detection network technology defined by ISO/IEC 8802-3.

15. Gateway: A device that translates BACnet messages into those of a non- BACnet protocol and vice-versa.

16. Internetwork: A set of two or more BACnet networks interconnected by routers.

17. Interoperability Area: A communications domain in which functional cooperation is desired. These areas are currently: 1) data sharing; 2) alarm and event management; 3) trending; 4) scheduling; and 5) device and network management. See BACnet, Clause 22.

18. IP: The Internet Protocol. A networking protocol originally developed by the federal Defense Advanced Research Projects Agency. BACnet messages can traverse the campus backbone by being encapsulated in routable IP packets.

19. Local: Pertaining to the requirements of a specific job or building project.

20. LAN: Local Area Network. One of the approved BACnet network technologies: Ethernet, ARCNET or MS/TP.

21. MS/TP: Master-Slave/Token-Passing Network. One of the approved BACnet LANs. See BACnet, Clause 9.

22. Network: One of the communication technologies for data communications specified in BACnet. Approved network technologies at Cornell are Ethernet, ARCNET, and MS/TP.

23. PICS: Protocol Implementation Conformance Statement. A document that describes in detail a device's BACnet capabilities. See BACnet, Annex A.

24. PM: Project Manager. The Owner's representative who oversees a BACS project.

25. Synchronization: In order to ensure that alarms are properly interpreted, the names of all BACnet objects within a device are stored in an EMCS database. This process of coordinating the names of the objects in the field devices and the EMCS is initiated manually whenever a device is installed or its objects have been updated. The EMCS reads the Object_List property of the device's Device object (a BACnetARRAY of Object Identifiers) and then reads each object's Object_Name property (a CharacterString). This Object_Name is used along with the EMCS device name to identify the alarms related to this object so it must be unique and descriptive.

26. UDP: The User Datagram Protocol. One of the IP family of protocols. UDP is used to convey BACnet/IP messages and is characterized by a "port number" for each protocol. BACnet/IP typically uses UDP port X'BAC0' or decimal 47808.

27. VLAN: Virtual Local Area Network. A network configuration that allows devices to communicate across multiple physical local area networks (LANs) using their hardware or "medium access control" (MAC) addresses as if they shared a common networking medium. As with a physical LAN, "local" broadcast messages are also propagated to each of the participating LANs. VLAN capability depends on the configuration of the interconnecting data communication equipment. VLAN configuration is performed by CIT.

28. Zone: The facilities on the Ithaca campus are divided into groups called "zones" for the purpose of maintenance management. Each has a "Zone Facility Manager" and controls technicians responsible for the BACS equipment in their zone.

1.6 SUBMITTALS

A. In addition to any requirements specified elsewhere, the Contractor shall provide both proposed and as-built versions of the following:

1. Schematic drawings that represent the system architecture and configuration, in both hardcopy and editable electronic format.

2. A points list that includes, for each physical or logical point, the name, description, display units, alarm limits and definitions, along with the BACnet object description, object ID, and associated device ID. The list shall also indicate whether Trend Log or Schedule objects have been established for the point.

3. Documentation for any non-standard BACnet objects, properties, or enumerations utilized detailing their structure, data types, and any associated lists of enumerated values.

4. PICS files indicating the BACnet functionality and configuration of each device. In addition to the requirements of BACnet, Annex A, the Contractor shall provide information on any limitations on the numbers of supported objects in a given device including, specifically, Trend Log and Schedule objects.

5. Documentation on submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL). If, for any reason, BTL testing and listing has not been completed, a written commitment shall be provided to upgrade installed controls to a version that meets BTL testing and listing requirements should deficiencies be found during BTL testing.

1.7 WORK INCIDENTAL TO TEMPERATURE CONTROL CONTRACTOR

A. The Contractor shall be responsible for all coordination of subcontractors’ work relative to the BACS. Specific questions relating to communication and interoperability shall be submitted to BACSI.

PART 2 - PRODUCTS

2.1 GENERAL

A. Each networked device supplied pursuant to this section shall be installed and configured to correctly execute all sequences of operation for its intended application, as defined in other sections of this guideline. In addition, each networked device shall provide, at a minimum, the BACnet communication capabilities prescribed in the device profiles for devices of its type.

2.2 CONTROLLER

A. Controller devices supplied to meet the functional and operational requirements of this guideline shall conform, at a minimum, to one of the BACnet device profiles contained in BACnet, Annex L: BACnet Building Controller (B-BC), BACnet Advanced Application Controller (B-AAC) or BACnet Application Specific Controller (B-ASC). The interoperability requirements of such devices are contained in BACnet, Annex L. B-BC controller devices shall communicate using BACnet/IP. Other devices may use BACnet over ARCNET or BACnet over MS/TP.

2.3 ROUTER

A. In the event that devices are provided that do not use BACnet/IP over Ethernet as their communication technology, BACnet routers shall be provided that route between BACnet/IP over Ethernet and the other BACnet LAN type(s), whether ARCNET or MS/TP. These routers shall conform to the specifications of BACnet, Clause 6.

2.4 GATEWAY

A. BACS devices that use BACnet as their native protocol are preferred. The use of gateways, in circumstances where no native BACnet devices are available, requires the specific approval of the Owner in each instance.

2.5 SWITCH & HUB

A. If the network topology of the job requires the use of network switches, they shall be selected from the list of approved hardware, which can be found at https://pminfo.emcs.cornell.edu/switch_hardware. In the event the job requires additional switches, the proposed design of the network topology including all CIT jacks, switches, and network connected BACS devices shall be submitted in advance to BACSI for approval. Schematic examples of typical extended network topologies can be referenced at the pminfo web site referenced above.

2.6 NON-BACNET DEVICE

A. For devices that are used for utility metering and other non- BACS applications, the Cornell EMCS provides several protocol handlers including Modbus and EtherNet/IP. Contractors supplying devices using these protocols need not provide a gateway.

2.7 WEB SERVER REQUIREMENTS

A. If a local workstation is required, the Contractor shall provide a web server computer with the web page presentation, data acquisition and storage functionality described in this section, including the specific functions listed below. The web server shall be configured in such a way that there is no software-imposed limit to the number of simultaneous users.

1. Data Sharing

a. Presentation of data (i.e., user definable reports and graphics)

b. The ability to monitor and display the values of all BACnet object types, including all required and optional properties

c. The ability to modify setpoints and parameters

2. Alarm and Event Management

a. Operator notification and presentation of event information

b. Alarm acknowledgment by operators

c. Alarm summarization

d. Adjustment of alarm limits

e. Adjustment of alarm routing

3. Scheduling

a. Modification of schedules

b. Display of the start and stop times (schedule) of scheduled devices

4. Trending

a. Modification of the parameters of a trend log

b. Display and archive of trend log data

5. Device and Network Management

a. Display of information about the status of any device on the BACnet internetwork

b. Display of information about any object on the BACnet internetwork

c. Ability to silence a device on the network that is transmitting erroneous data

d. Ability to cause a remote device to reinitialize itself

e. Ability to backup and restore the configuration of devices on the local BACnet network

f. Ability to query and change the configuration of local BACnet routers

2.8 DUAL HOME EQUIPMENT

A. To protect network security, dual-homed devices, i.e., devices with two (or more) Network Interface Cards that have an identity on a BACSI-administered LAN and another non-BACSI-administered LAN, e.g., a locally administered laboratory LAN is strictly prohibited without prior written authorization by BACSI.

2.9 LAN

A. All control devices meeting the B-BC device profile shall be connected to an ISO 8802-3 (Ethernet) LAN provided by the Contractor. This LAN, in turn, shall be connected to the campus backbone network. Unless otherwise specified, the connection shall be via a 10/100/1000BASE-T port provided by the Owner. The location of the jack will be determined in consultation with BACSI, which will arrange for the jack's installation. The Contractor shall also provide any additional data communication hardware, such as switches, hubs, and repeaters that may be needed to interconnect the supplied BACS equipment and to connect to the Owner's backbone network. Although cascaded switches and hubs are not prohibited, they must meet the requirements.

B. To facilitate maintenance technician access to the LAN, the Contractor shall also provide at least one additional 10/100/1000BASE-T access point in each mechanical room that contains BACS equipment. This requirement may be met by supplying either a hub with a spare port or a dedicated jack.

C. Control devices that meet the B-ASC profile, but do not support Ethernet, must use another approved BACnet LAN technology. All controls shall support BACnet/IP communication protocol. If Ethernet is not supported on any part of the internetwork, a standalone BACnet router, or a BACnet Building Controller with built-in routing capability, must be provided for routing between the Ethernet and BACnet/IP.

PART 3 - EXECUTION

3.1 DATA SHARING

A. Data Sharing requirements apply to the exchange of information between BACnet devices for archival storage, generating graphics and reports, the sharing of common sensor or calculated values, carrying out interlocked control strategies, and the modification of setpoints or other operational parameters.

B. All such data to be exchanged shall be represented as BACnet objects and conveyed using BACnet messages. Only standard BACnet objects and messages may be used to implement data sharing requirements unless the non-standard extensions are explicitly approved by the Owner. Any extensions to BACnet shall be fully documented in the manner used within the BACnet standard.

Submission of such documentation is a prerequisite for obtaining approval of an extension.

C. Points List: The Contractor shall provide devices installed and configured with all points indicated in the BACS points list. The Contractor shall provide any additional points needed to fully implement the sequence of operations and other functionality described in this guideline.

D. Data Presentation: The following characteristics shall apply to graphic displays:

1. The graphic displays shall include schematic diagrams of the systems being displayed.

2. When a graphic display is being viewed, all values displayed shall be updated when a change of value (COV) notification is received or, if COV is not implemented, within five seconds.

3. Any data value from any networked device shall be available for plotting in real time. The operator shall be able to select binary and analog data concurrently and to plot multiple instances of each datatype on the same screen. The operator shall be able to select sampling intervals from 1 second to 60 seconds. For devices that implement COV reporting, the operator shall be able to select this as the means to update the plot. It shall be possible to save such real-time plots for subsequent recall.

E. Monitoring of Any Property: The operator shall be able to display any value of any property of any object from any networked device including all properties required by BACnet, all supported optional properties, and any proprietary extensions.

F. Global Object Definitions: The control system shall be configured with system- wide unique BACnet objects as needed to convey all globally significant information necessary to implement the control strategy.

G. Setpoint and Parameter Modifications: Operators with appropriate authority shall be able to modify all control loop setpoints and tuning parameters via BACnet messages initiated through operator interaction with graphics displays.

H. Peer-to-Peer Data Dependencies: All BACnet devices shall be installed and configured to exchange data values directly, without the need for operator intervention, to implement the sequence of operations specified in the mechanical system drawings and to share global data values. BACnet network points set up to acquire data from a peer device shall use dynamic binding. If static binding configurations are necessary, prior permission from BACSI must be obtained.

3.2 ALARM AND EVENT MANAGEMENT

A. Alarm and Event management is the exchange of data between BACnet devices related to the occurrence of predefined conditions that meet specific criteria. Such conditions are called "events" and may be the basis for the initiation of a particular control action in response or the simple logging of the event's occurrence.

The event may also be deemed to represent a condition that constitutes an "alarm" requiring human acknowledgment and intervention.

B. All alarms and events shall be implemented using standard BACnet event detection and notification mechanisms. Either intrinsic reporting or algorithmic change reporting may be used but the intrinsic reporting method is preferred. See BACnet, Clause 13.

C. Alarm Lists

1. The Contractor shall provide devices installed and configured to detect alarms and events for the points indicated in the system drawings. Software logic shall be provided to avoid nuisance alarms, e.g., no temperature or status alarms shall be generated when fan systems are not running or during start-up and shutdown transitions. It shall be possible to configure a delay between the occurrence of an alarm condition and its enunciation.

2. Alarms shall be annunciated on the network within five seconds of their occurrence. The graphics shall display an alarm message window that appears on top of any other open windows. The alarm message window shall have a distinctive color and appearance to attract the operator's attention. Operators with sufficient privilege shall be able to configure the controls to emit an audible signal (or not) when an alarm message is received.

3. Alarms that require operator acknowledgement shall cause the alarm window to remain active until such an acknowledgement is received. If multiple alarms are received, unacknowledged alarms shall be displayed on a first come first served basis grouped by priority, with the highest priority alarms displayed first.

4. Alarms shall be distributed using the BACnet notification class mechanism. Assignment of classes and destinations shall be configured according to details provided by the Owner.

5. BACnet provides a mechanism for prioritizing alarm and event notification messages using a numerical range of 0-255 with 0 being the highest priority and 255 being the lowest priority. The priorities are consistent with the safety requirements of UL 864 (applies to fire systems) and UL 1076 (applies to security systems).

6. Alarm and event notification priorities shall be configured in the Priority Range and shall be conveyed using the indicated Network Priority. See BACnet, Clause 6.

7. See Exhibit "A", "Cornell Alarm and Event Priorities" at end of this Section for configuration and priorities of all alarms and event notifications.

D. Alarm Acknowledgment: Alarms shall be acknowledged through the EMCS alarm acknowledgement process.

E. Alarm Summarization: Alarm summarization shall be handled through the EMCS alarm summarization process.

F. Alarm Parameter Adjustment: Operators with sufficient privilege shall be able to change alarm parameters for all standard BACnet event types.

G. Alarm Routing Adjustment

1. Operators with sufficient privilege shall be able to change alarm routing (BACnet notification classes) for each alarm including the destination for each type of alarm and alarm priority, the day of week, time of day, and the type of transition involved (TO-OFFNORMAL, TO-NORMAL, etc.).

2. Initially, notification classes shall be configured in a manner that distinguishes between the EMCS and any local alarm.

3.3 SCHEDULING

A. Scheduling is the exchange of data between BACnet devices related to the establishment and maintenance of dates and time at which specified output actions are to be taken. All schedules shall be implemented using BACnet objects and messages.

B. Schedule Lists

1. The Contractor shall provide devices installed and configured with start/stop, mode change, and night setback schedules as defined in the sequence of operations. As part of the installation process, the Contractor shall configure vacation, holiday, and any special event schedules as provided by the Owner.

2. The system shall have the ability to program alterations to programmed operating schedules based on the priority of events.

3. Based on operator privileges, the operator shall have the ability to temporarily override the programmed schedule of equipment. Operational override of a programmed schedule shall be for a specific duration following which the schedule shall revert back to the preprogrammed schedule.

C. Display of Start and Stop Times and Actions: An operator shall be able to inspect the content of any schedule and determine the specific control actions that will occur at any time, on any date. For any particular device or system parameter that is the subject of a schedule, an operator shall be able to determine the schedule of actions related to that particular device or parameter.

D. Modification of Schedules: All calendar entries and schedules shall be modifiable from the EMCS or locally by an operator with sufficient privilege.

3.4 TRENDING

A. Trending is the accumulation of (time, value) data pairs at specified rates for a specified duration. Trends are distinguished from real-time plotting of data by the fact that the data are destined for long-term storage.

B. Archival Storage of Data: Archival storage of data will be handled by the EMCS. However, the Owner may specify local trend archiving and display through the use of BACnet Trend Log objects.

C. Modification of Trend Log Parameters: An operator with sufficient privilege shall be able to change the data points to be logged, the sampling rate, and the duration of a trend log.

3.5 DEVICE AND NETWORK MANAGEMENT

A. Device and network management is the exchange of data between BACnet devices concerning the operation and status of specific devices. The following functions shall be available:

1. Display of Device Status Information: Operators shall be able to display at any time the operational status of any device on the BACnet internetwork.

2. Display of BACnet Object Information: Operators shall be able to display at any time any property of any BACnet object. Operators shall be able to display property values of objects grouped by object type, object location, and building system.

3. Silencing Devices that are Transmitting Erroneous Data: Operators shall be able to direct a field device to stop transmitting event, alarm, or COV notifications until a subsequent command to resume transmissions is received.

4. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device or all devices on a single local network.

5. Remote Device Re-initialization: Operators shall have the ability to issue re-initialization commands to any device that supports remote re-initialization.

6. Backup and Restore: Operators shall have the ability to backup and restore all BACnet devices on the network that support this capability.

7. Configuration Management of Half-Routers, Routers and BBMDs: Operators shall have the ability to display and modify the routing table entries in all supplied BACnet half-routers and routers and the broadcast distribution and foreign device registration tables in all BBMDs. Cornell BACS networks typically employ non-vendor-supplied BBMDs. Therefore, BACS devices should never be configured as a BBMD without prior authorization from BACSI.

3.6 USE OF BACNET OBJECTS

A. Naming Conventions: The following sections list the requirements for the assignment of names and identifiers for BACnet objects.

1. Device Names:

a. The EMCS uses a system for naming its control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served.

b. Names can be up to 254 characters in length, without embedded spaces. Only the characters A-Z, 0-9, ".", and "-" may be used.

c. The goal is the shortest descriptive, but unambiguous, name. For example, if there were only one chilled water pump "P1", a valid name would be "DUFFIELD.CW.P1.CONTROL". If there are two pumps designated "P1", one in the basement mechanical room and one in the penthouse mechanical room, the names could be "CHP.BSMT.CW.P1.CONTROL" or "CHP.PENT.CW.P1.CONTROL". In the case of unitary controllers, for example a VAV box controller, a name might be "COURT.122.TV- LOUNGE". These names should be used for the value of the "Object_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

2. Device Instance Numbers

a. BACnet allows 4194304 device instances per BACnet internetwork, each of which must be unique. Cornell's unique device instances are formed as follows: Device Instance = "FFFFNDD" where:

1) FFFF = Facility Code

2) N = 0-9 This allows up to 10 networks per facility or building

3) DD = 00-99 This allows up to 100 devices per network

b. Facility Code assignments are unique four-digit numbers assigned by the Facilities Inventory Office. Some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored.

c. Network numbers for facility codes above 4193 and for facilities that require more than 10 BACnet networks will be assigned in the range 0000-0999.

d. The Contractor shall contact BACSI for assignment, or confirmation, of the BACnet network and device instance numbers to be used prior to beginning device configuration. In the event of renovation or addition, the existing device instances are available and should be planned around as part of the project.

3. Non-Device Object Names: Objects other than Device objects shall be named in a manner analogous to Device objects. The names shall consist of a facility, sub-facility system, sub-system point designation. All BACnet object names within a particular device must be unique within that device. For those objects that will be used to generate alarms, the point name should be descriptive of the alarm. Point names are synchronized with the EMCS database at the completion of each installation or update and the object name will appear in the EMCS alarm notification.

4. Non-Device Object Instance Numbers: The instance numbers for objects other than Device objects may be assigned at the Contractor's discretion subject only to the constraint that they be unique for a given object type within a given device.

B. Commissioning / Diagnostic Mode: In order to support commissioning and troubleshooting functions, the Out_Of_Service property of all Analog, Binary, Multi-state, Loop, and Program objects shall be writable using BACnet services.

C. Using Object Descriptions

1. Each Device object and every object in BACnet Building Controllers (B-BC) shall be configured with a Description property. The descriptions used shall be submitted to the Owner for approval.

2. For all object types in all devices that support Description properties, the available string length and whether or not the Description is writable using BACnet services shall be specified in the device's PICS.

D. Issues Relating to Specific BACnet Object Types: This section provides requirements that pertain to the use of specific BACnet object types. For those object types that support Change of Value (COV) reporting, the COV_Increment must be set to a value appropriate for the parameter being measured, typically 10% of the normally expected steady state value.

1. Analog Input, Output, and Value: All Analog_Input, Analog_Output, and Analog_Value objects shall have the capability of using the COV reporting mechanism and the COV_Increment property shall be writable using BACnet services.

2. Binary Input: The Inactive_Text and Active_Text properties of Binary Input objects shall be configured with text string values as indicated on the points list. Binary Input objects shall support COV reporting.

3. Binary Output: The Inactive_Text and Active_Text properties of Binary Output objects shall be configured with text string values as indicated on the points list.

All Binary Output objects associated with motor on/off status shall track changes of state and runtime. Binary Output objects shall support COV reporting.

4. Binary Value: The Inactive_Text and Active_Text properties of Binary Value objects shall be configured with text string values as indicated on the points list. Binary Value objects shall support COV reporting.

5. Calendar: Devices providing scheduling capability shall also provide at least one Calendar object with a capacity of at least ten entries. Operators shall be able to view the calendar object and make modifications. If the Calendar's Date_List property is writable using BACnet services, all calendar entry datatypes shall be supported.

6. Loop: All control loops using any combination of proportional, integral, and/or derivative control shall be represented by BACnet Loop objects. Operators with sufficient authority shall be able to adjust at least the Update_Interval, Setpoint, Proportional_Constant, Integral_Constant, and Derivative_Constant using BACnet services. Loop objects shall support COV reporting.

7. Multi-state Input, Output, and Value: The text to be used for the Multi-state object types shall be determined from the points list. Feedback_Value shall be determined by sensing the actual condition or mode of the device. All Multi-state objects shall support COV reporting.

8. Schedule: All building systems with date and time scheduling requirements shall have schedules represented by BACnet Schedule objects. All operators shall be able to view the entries for a schedule. Operators with sufficient privilege shall be able to modify schedule entries. Required schedules are shown on the drawings as part of the occupied and unoccupied modes.

E. Dynamic Object Creation: BACnet Building Controllers shall be configured to allow the dynamic creation of Trend Log, Calendar, and Schedule objects by means of the BACnet CreateObject service.

3.7 USE OF BACNET SERVICES

A. Interoperable Commands: All dampers, valves, fans, or other mechanical equipment that may need to be controlled by more than one application shall be represented as commandable BACnet objects. The application programs interacting with this equipment shall be configured to use the command priorities listed in Table 2. If implementing the sequence of operations or other required functionality requires using a command priority not listed in Table 2, the priority assignment must be approved by the Owner.

B. See Exhibit "B", " Cornell Command Priorities " at end of this Section for configuration of all command priorities.

C. Alarming: This section provides requirements that are specific to the use of BACnet for alarm processing.

1. Notification Classes:

a. The EMCS shall be designated as a recipient for all alarm notifications.

b. The Priority, Ack_Required, and Recipient_List properties of Notification Class objects shall be writable over the network using BACnet services.

2. Event Notification Message Texts: Alarm and event processing shall be configured to convey descriptive text messages along with the notification.

D. Operator Authority Levels: There shall be at least three levels of authority:

1. Administrator - All privileges

2. Controls Technician - All programming and configuration

3. Building Coordinator - Read only

4. Commissioning Agent – Read only

5. A/E, Consultant, Facilities - Read only

E. Change of Value Processing

1. Property values shall be displayed based on the receipt of confirmed and unconfirmed Change of Value notifications. Operators shall have the ability to subscribe to COV notifications for all objects that support COV subscriptions.

2. After initialization, all graphic display screens shall update the displayed values using COV notifications if COV notification capabilities are available from the data source.

3. The COV increment shall be adjustable by an operator using BACnet services.

3.8 LOCAL AREA NETWORKS

A. This section provides requirements that are specific to the integration of multiple BACnet networks, possibly on different LAN types, into a single BACnet internetwork.

B. Network Numbering:

1. Cornell BACnet network numbers are based on a "facility code, network" concept. The "facility code" is the Cornell-assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internetwork.

2. Cornell's network numbers are thus formed as follows: Network Number = "FFFFN" where:

   a. FFFF = Facility Code

   b. N = 0-9 This allows up to 10 networks per facility or building

3. N = 0 (zero) will generally be assigned to a facility's BACnet Ethernet LAN. Normally, this network is connected to the campus backbone. The additional N-numbers will be assigned to any ARCNET or MS/TP networks as required.

4. The Contractor shall contact BACSI for assignment, or confirmation, of the Network Number(s) to be used prior to beginning device configuration.

C. IP Address Assignments:

1. Cornell maintains specially configured VLANs for the purpose of securely transporting BACS communication traffic. Address assignments are coordinated by BACSI.

2. The Contractor shall contact BACSI for assignment of IP addresses (and possibly non-standard UDP ports) prior to beginning device configuration.

3.9 BACNET ROUTERS

A. The Contractor shall configure each BACnet router to transmit network layer (routing) error messages to the EMCS.

3.10 PROCEDURES

A. For demolition or removal of existing control equipment, or the addition of new control equipment on the campus backbone network, the contractor shall inform the Energy Management and Control System (EMCS) Operations at 607-255-5777 prior to any potential connection to, or interruption of, the data communication network. Additional current information can be found at pminfo.emcs.cornell.edu.

B. Installation, Modification, Retrofit, and Removal of BACS Hardware and Software:

1. Prior to commencing work:

   a. The Contractor shall notify EMCS of the scope of work, date work is to start, tentative schedule of remaining work, and the contact information for the responsible application engineer, technicians and contractor personnel.

   b. On larger Projects (300 or more devices), the Contractor shall conferred with EMCS/BACSI regarding measures to be employed during construction to protect the BACS network infrastructure of the University before and during the project, e.g., firewalls, sequestered construction servers, Virtual Private Network connections, etc.

Transfer of programs, point names, and other configuration from the construction server to the production server should be done by the vendor as part of commissioning.

c. The Contractor shall review with, and provide documentation to, EMCS/BACSI regarding the network topology and device instance numbering scheme for the new controls being installed. Upon job completion, accurate as-built drawings are required that clearly show the network topologies including all switches, repeaters, and devices, both for IP and child MS/TP and ARCNET networks.

d. The Contractor confers with the Zone Facility Manager prior to any demolition activities. Demolition activities should be planned to proceed in an orderly way to minimize impact and disruption to Campus BACS networks.

2. On Projects involving retrofit/replacement of existing BACS devices in a facility:

a. Upon request, EMCS will provide an MS-Excel spreadsheet that indicates which existing points appear in EMCS graphics, trends and reports; which points have previously come into alarm; and the remaining points in the controller.

b. The Contractor shall then provide to EMCS a mapping of all controller points that have been renamed or removed showing the old and new designation or status.

c. The Contractor shall inform EMCS of all changes to communication, including any addresses that have been retired, replaced, etc., so that the Owner's network database can be kept current.

d. As new BACS devices are added to Campus networks, the Controls Contractor shall complete and submitting the appropriate checklists for EMCS/BACSI and EMCS General Foreperson review. Visit http://pminfo.emcs.cornell.edu for downloadable copies of the checklists. Devices added to in-service non-sequestered building automation networks must be configured and submitted to EMCS for definition and synchronization within one business week of activation.

3. When the Controls Installation is complete and the project desires alarm reporting to EMCS:

a. EMCS/BACSI shall review with the Contractor previous submitted documentation, status of job, and network safety measures in place.

b. EMCS/BACSI will work with the PM and the Contractor to complete final integration of new controls into the Campus BACS infrastructure, including defining and synchronizing field panels with the EMCS database for alarm reporting.

C. Check out of BACnet/IP Installations

1. Prior to connection to the Campus backbone network, it must be demonstrated to the EMCS General Foreperson that these criteria have been met:

   a. The IP address, subnet mask and IP gateway address of the device to be connected must be shown to be correct for the network connection about to be made.

   b. The device's Device Name must be shown to conform to Cornell standards.

   c. The names of BACnet objects within a device must be shown to conform to Cornell's naming conventions.

   d. The device's Device Instance Number (DIN) must be shown to conform to Cornell's naming conventions.

2. In the case of devices that route to subordinate BACnet MS/TP or ARCNET networks, the network numbering must be shown to conform to Cornell numbering standards.

3. The BACnet alarm Recipient List must contain the DIN (or BACnet Address, i.e., [BACnet Network Number, MAC Address]) of both the appropriate vendor server (ALC or Alerton) and the EMCS alarm server.

4. For each device containing network variables, a list of network variables must be provided showing that each network variable references a valid network-accessible point.

5. For each device containing points that are to issue UnconfirmedCOVNotifications, a list of the points and their respective Change of Value (COV) increments must be provided to prove that the device will not generate COV storms.

6. BACnet Broadcast Management Device (BBMD) capability must be shown to be disabled unless explicitly authorized by Cornell, i.e., the device's Broadcast Distribution Table (BDT) must be shown to be empty or non-existent.

7. Ethernet devices must be connected to CIT provided Ethernet network jacks, or a CIT managed switch. In the event a switch needs to be installed in a mechanical room, closet, enclosure, or other non-CIT node room location, the switch can be procured from CIT network engineering. The equipment used must be selected from the list of approved equipment.

EXHIBIT "A" – CORNELL ALARM AND EVENT PRIORITIES

MESSAGE GROUP	PRIORITY RANGE	NETWORK PRIORITY	BRIEF DESCRIPTION
Life Safety	0 - 31	Life Safety Message	Notifications related to an immediate threat to life, safety, or health such as fire detection or armed robbery
Property Safety	32 - 63	Life Safety Message	Notifications related as an immediate threat to property such as forced entry
Supervisory	64 - 95	Critical Equipment Message	Notifications related to improper operation, monitoring failure (particularly of Life Safety or Property Safety monitoring), or monetary loss
Trouble	96 - 127	Critical Equipment Message	Notifications related to communication failure (particularly of Life Safety or Property Safety equipment)
Miscellaneous Higher Priority Alarm and Events	128 - 191	Urgent Message	Higher-level notifications related to occupant discomfort, normal operation, normal monitoring, or return to normal
Miscellaneous Lower Priority Alarm and Events	192 - 255	Normal Message	Lower-level notification related to occupant discomfort, normal operation, normal monitoring, or return to normal

EXHIBIT "B" – CORNELL COMMAND PRIORITIES

PRIORITY LEVEL	APPLICATION	PRIORITY LEVEL	APPLICATION
1	Manual-Life Safety	9	Available
2	Automatic-Life Safety	10	Available
3	Available	11	Load Shedding
4	Available	12	Available
5	Critical Equipment Control	13	Available
6	Minimum On/Off	14	Available
7	Available	15	Available
8	Manual Operator	16	Available

END OF SECTION

BUILDING AUTOMATION CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

A. The Building Automation Control System (BACS) is configured as a network with control functions at multiple levels, and with multiple points of operator control and supervision. The BACS includes web-based access, the Energy Management and Controls System (EMCS), data transmission systems, field panels and controllers, necessary interfacing controls, sensors and actuators. The controllers contain microprocessors and other supporting electronics that perform local control functions and execute application programs without requiring communications with the centralized head-end computers or workstations.

1.2 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings. Provide a complete Building Automation Control System (BACS), to perform the functions described in this Section. Provide wiring and conduit required to connect devices furnished as a part of, or accessory to, this automatic control system. Control wiring is defined as wiring up to and including 120 volts. Install wiring in accordance with requirements of "Electrical Wiring" in Section 230504, and the National Electrical Code. Provide all required devices for proper system operation, including special electrical switches, transformers, relays, push button stations, etc.

1. All Actuation of valves and dampers shall be electric unless specifically called out elsewhere in the specifications or drawings.

B. The BACS shall have the following capabilities as described in these specifications:

1. The network controllers shall be connected directly to the Owner's Ethernet Network. The network controller shall also contain SNMP for integration to the Owner's Network Controllers System.

2. The system shall be capable of sending both emails and text messages, and calling phone numbers for alarms. Coordinate with the Owner for email addresses, phone numbers and alarms.

3. Network controllers shall all be flash upgradeable and not require changing chips for upgrades.

4. Short term logging of historical data shall be provided for every BACS input and output in the system. Each point shall be capable of being logged for a minimum of two (2) weeks.

C. The BACS shall consist microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

D. The system shall consist of the following components:

1. Provide Ethernet-based network controllers as described in this specification. Controllers shall connect directly to the Operator Workstation over Ethernet, provide communication to the Standalone Digital Control Units and/or other Input/Output Modules and serve as a gateway to equipment furnished by others.

2. Provide the necessary quantity and types of standalone controllers to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each standalone controller shall operate completely standalone, containing all of the I/O and programs to control its associated equipment.

3. A high-speed Ethernet connection to the site shall be used for offsite access to the site. Coordinate with the Owner's IT professionals for high-speed system access and shall comply with Owner's requirements to maintain the level of security required by the Owner. Coordinate with Owner and provide VPN (Virtual Private Network) as required, to comply with the Owner's IT professionals requirements.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230504 – Electric Wiring

B. Section 230901 – Building Automation Control System Communications.

1.4 QUALITY ASSURANCE

A. The complete automatic temperature control system shall be comprised of electric control devices with a microprocessor based Direct Digital Control System. All work shall be installed only by skilled mechanics employed by the BACS Contractor or Subcontractor.

B. The BACS Contractor/Subcontractor shall have a minimum of five (5) years experience in systems of similar size, type and complexity installed within a 100 mile radius.

C. The BACS Contractor/Subcontractor shall have a local service department (within a 50 mile radius) and have available a minimum of three (3) factory trained technicians within a 24 hour period.

D. All components shall be fully tested and documented to operate as a complete system.

E. Supplier must guarantee that all replacement parts will be carried in stock for a period of ten (10) years minimum from the date that the system is commissioned.

F. Electrical standards: Provide electrical products that comply with the following agency approvals:

1. UL 916; Energy Management Systems for Temperature Control components and ancillary equipment.

2. UL 873; Temperature Indication and Regulating Equipment.

3. FCC, Part 15, Subpart J, Class A Computing Devices.

G. All products shall be labeled with the appropriate approval markings. System installation shall comply with NFPA, NEMA, Local and National codes.

1.5 ACCEPTABLE MAKES

A. The complete Building Management System is designed and based on that manufactured by Automated Logic Corporation. Acceptable Makes: Automated Logic Corporation, Alerton, or equal.

1.6 SUBMITTALS

A. Submit for review, a brochure containing the following:

1. Floor Plans: Floor plans shall include all controllers/control panels, sensors, interface devices, remote pressure transmitters, smoke detectors, control valves, control dampers, flow meters, UPS's, etc., and all network components (repeaters, routers, etc.). Network wiring shall be shown and identified on the floor plan drawings.

2. Control System Architecture Diagram: System architecture one-line diagrams shall indicate schematic location of all controllers, LAN switches and interface devices, gateways, etc. Indicate address and type for each control unit; as well as physical media, protocol, communication speed, and type of each LAN.

3. Control Schematic Drawings: Control schematics shall be generated to graphically indicate each functional system, show the schematic configuration of the systems and location of control devices, define the point names and addresses (as applicable), and define the setpoints for control elements. The following information shall be included in the control schematics at a minimum:

a. BACS legend and abbreviations.

b. BACS one-line Architecture diagram.

c. Point names and types.

d. Normal position of output devices.

e. Setpoints.

f. Point addresses and device ranges per Cornell Standard Section 230901.

g. Complete bill of materials listing all devices and manufacturer numbers.

4. List of all points, including alarms and trends: A listing of all input/output (I/O) points shall include all physical and virtual points, organized by system/sub-system; names, descriptors, and point types; as well as the following:

a. Hardware & Software point type and addresses.

b. Specific input points that must be able to be put in test mode to facilitate commissioning.

c. Listing of any associated alarms, as well as annunciation location (BACS, EMCS, etc). Control loops shall include an adjustable deviation from setpoint alarm based upon error and time. The alarm parameters shall be the state the point is in to cause a particular alarm, including whether the source system is also enabled. Examples of points in this list are as follows:

5. Detailed written sequences of operation.

6. Submit a valve and damper scheduled showing size, pressure drop configuration, capacity, and locations. Provide apparatus Bulletins and data sheets for all control system components.

7. Product Data: The BACS vendor shall submit manufacturer's technical product data for each control device, panel, controller, and accessory furnished indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation, start-up, calibration, and maintenance instructions as well as all cable and tubing requirements.

8. Wiring Diagrams: The BACS vendor shall include detailed wiring. Indicate all required electrical wiring. Wiring diagrams shall include both ladder logic type diagrams for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on the system schematic. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed. All wiring of related components that make up a system shall be grouped together in one diagram (e.g., all wiring diagrams for the components and devices on a particular AHU shall be shown on one drawing. The supply fan components and devices shall not be shown separate from return fan components and devices, etc.).

B. Record Documents: Record documents shall be prepared reflecting the final installed condition of the BACS. These as-built documents shall be kept up to date throughout the construction and warranty period. Provide the following information for approval prior to project closeout:

1. Maintenance instructions and spare parts list for each type of control device, control unit, and accessory.

2. BACS User's Guides (Operating Manuals) for each controller type.

3. BACS Programming Manuals for each controller type.

4. All information provided during the submittal phase; updated with as-built information. As-built panel drawings shall also be included as part of the O&M manual process. The drawings that are located in each panel shall incorporate all the systems controlled from that particular panel.

The drawings shall include the system schematic and detailed panel wiring diagram. The specific locations of any remote devices such as remote static pressure sensors and differential pressure sensors shall be noted on the plans.

5. Each control panel on the project shall include an as-built hard copy of all drawings and documentation associated with that panel and its field devices. This documentation shall be provided in a plastic protective pocket mounted inside the panel door.

6. As-Built Program: Databases with logic, graphics, trends, setpoints, and tuning parameters.

1.7 SCOPE OF WORK

A. Except as otherwise noted, the control system shall consist of all Ethernet Network Controllers, Standalone Digital Control Units, software, sensors, transducers, relays, valves, dampers, damper operators and other accessory equipment, along with a complete system of electrical interlocking wiring as required to fill the intent of the specification and provide for a complete and operable system.

B. The BACS Contractor/Subcontractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.

C. All interlocking, wiring and installation of control devices associated with the equipment shall be provided under this Contract. The BACS Contractor/Subcontractor shall demonstrate the operation of the system to the Owner and prove that it complies with the intent of the drawings and specifications.

D. Provide services and manpower necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative. Commissioning reports showing the testing of each BACS point on the system shall be submitted to the Engineer for review and approval upon completion of the commissioning process. Refer to the Mechanical and Electrical Commissioning Specification Section 230800 and 260800.

1.8 WORK INCIDENTAL TO BACS CONTRACTOR

A. The BACS Contractor/Subcontractor shall furnish the following materials, installation by the HVAC Contractor:

1. For piping work:

a. Control valves in piping.

b. Immersion sensing wells in piping systems.

c. Valved pressure taps.

2. For sheet metal work:

a. All automatic dampers, the BACS Contractor/Subcontractor shall assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper and motors.

b. The HVAC Contractor shall provide access doors or other means of access through ducts or ceilings and walls for service and adjustment of controllers, valves, and dampers.

B. Control manufacturer shall furnish written details, instructions and supervision for the above trades to ensure proper installation size, and location of any equipment furnished for installation by others.

C. The BACS Contractor/Subcontractor is responsible for providing 120 volt dedicated power to all BACS panels and for providing 120 volt dedicated power emergency power with surge protection to all BACS panels, where noted.

D. Electrical trade to provide occupancy sensors unless noted otherwise. Refer to responsibility matrices in Part 3.

E. The BACS to provide 120 volt dedicated power and control transformers at all microprocessor based VAV terminal unit controllers. As an option, provide control transformers sized to serve multiple VAV terminal unit controllers and laboratory air valve controllers. The Electrical Contractor is responsible for providing a junction box or boxes to obtain power, on a per floor basis. See electrical plans for locations.

F. BACS Contractor/Subcontractor is responsible for providing Ethernet data drops at main building controller and IP controllers.

1.9 SYSTEM ADJUSTMENT AND CALIBRATION

A. When the Work has been completed, completely adjust and calibrate the control system. Review the operation of each system input and output, control loops and/or software routings, timing functions, operator entered constants and facilities management functions and observe that they perform their intended functions. Provide a complete values and points log, printed every hour, for one week to demonstrate control functions and programming. Provide one point log for summer operation and one winter. Points to be trended shall be selected by the engineer. When above procedure has been completed and the control system is operating satisfactorily, submit a letter with one copy of completed values and points log to the Owner's Representative advising them that the control system is 100% complete and operates in accordance with the Contract Documents.

B. After review and approval of points log by the Engineer, the BACS Contractor shall schedule a technician on site for field review of system components, operation and graphics as part of final system appearance.

1.10 WARRANTY

A. Except as otherwise specified, the Contractor shall warrant and guarantee all work against defects in materials, equipment, and workmanship for a period of one (1) year from the date of acceptance of the work as evidenced by a resolution to that effect by the Owner, and for that period of time noted in special or extended warranties.

1. Maintain temperatures within 1°F above and below setting.

2. Humidity devices shall maintain relative humidity conditions within 3% of span 0-100% RH.

B. The period of one (1) year shall be extended with respect to portions of the work first performed after substation completion by the period of time between substantial completion and actual performance of the work.

C. The Contractor shall provide all recommended preventative maintenance of the materials, equipment, and workmanship as necessary and as described in the operating and maintenance manuals during the warranty period. In addition, the Contractor shall provide two (2) semi-annual service visits (i.e., one visit during the peak cooling season and one visit during the peak heating season) to test and evaluate the performance of the equipment. The Contractor shall provide a written report of the test and evaluation results. The service visits shall include, but not be limited to:

1. Checking and, if necessary, correcting the calibration of the sensors, transducers, and transmitters for air flow, liquid flow, pressure, temperature, and humidity.

2. Checking and, if necessary, correcting the operation of the dampers and damper actuators.

3. Checking and, if necessary, correcting the operation (i.e., monitoring and command) of the system points.

D. Software and Hardware Updates - At the end of the first six months, and during the subsequent six months, the BACS Contractor shall update the equipment and any controllers, servers, workstations, and HMI Web servers with the latest modifications and improvements in software, firmware, and hardware that the manufacturer may have incorporated in the furnished equipment.

PART 2 - PRODUCTS

2.1 SENSORS

A. Temperature Sensors / Transmitters:

1. Temperature sensors / Transmitters shall comply with the following as a minimum:

a. Resolution: When matched with A/D converter of the controller, sensor range shall provide a resolution of no less than 0.4°F (unless noted otherwise) over a range of -30 to 230°F.

b. Accuracy: +/- 0.4°F accuracy at calibration point. When used in combination with a humidity and/or CO_2 sensor, +/- 0.5°F is acceptable.

c. Element: Thermistor.

2. Room Temperature Sensor:

a. These shall be an element contained within a ventilated cover, suitable for wall mounting on a standard electrical box. Provide an insulated base. Provide in white, unless noted otherwise.

b. Setpoint Adjustment: Provide set point adjustment where indicated. The setpoint adjustment shall be a warmer/cooler indication that shall be scalable via the BACS. Programmable scale shall have the capability to be limited via the BACS. Public spaces shall not have setpoint adjustment.

c. Occupancy Override: Where spaces do not have occupancy/vacancy sensors, provide a button on the room sensor enclosure where indicated. This shall be a momentary contact closure. Public spaces shall not have occupancy overrides.

d. Display: Alphanumeric.

3. Single Point Duct Temperature Sensor:

a. These shall consist of a sensing element, junction box for wiring connections, and a gasket to prevent air leakage or vibration noise. The sensor probe shall be stainless steel.

4. Averaging Duct Temperature Sensor:

a. These shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide sensor lengths and quantities to result in one foot of sensing element for each, two square feet of coil/duct face area. The averaging sensor tube shall contain at least four thermistor sensors.

5. Liquid Immersion Temperature Sensor:

a. These shall include thermowell, sensor and connection head for wiring connections. Thermowell shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.

6. Outside Air Temperature Sensor:

a. These shall consist of a sensor, sun shield, utility box, and watertight gasket to prevent water seepage. Materials shall be non-corroding and resistant to UV exposure.

B. Humidity Sensors:

1. Sensors shall comply with the following as a minimum:

a. Input Range: 10 to 100% RH.

b. Operating Range: As required by the application.

c. Long Term Stability: Less than 1% drift per year.

d. Accuracy:

1) General Duty, monitoring: +/- 3% RH between 20-90% RH at 77 °F, including hysteresis, linearity, and repeatability.

2) High Accuracy control, enthalpy calculation, dewpoint calculation, humidification and dehumidification control: +/- 2% RH between 20-90% RH at 77 °F, including hysteresis, linearity, and repeatability.

2. Device shall be suitable for duct, wall, or outdoor mounting. Device shall be combined into one device with temperature and CO2 sensors, where applicable. Sensors shall be two-wire transmitters utilizing bulk polymer resistance change or thin film capacitance change. Units shall produce linear continuous output of 4-20 mA for % RH. Duct sensors and outdoor air humidity sensors shall be suitable for ambient temperature conditions of -40 to 212°F.

C. Carbon Dioxide (CO_2) Sensors:

1. CO_2 measurement shall be accomplished with Non-Dispersive Infrared (NDIR) technology. Sensors shall comply with the following as a minimum:

a. Uncertainty: Shall be no greater than ±75 ppm (or ±7% of Reading <500 ppm and ±7.5% for 800 – 1,200 ppm) at 77° F (25° C) for a CO_2 measurement range of at least 400 – 2,000 ppm.

b. Stability: Less than 2% FS, over the expected 15 year life of the typical sensor.

2. Each CO_2 sensor node shall be factory calibrated, shall automatically self-calibrate during operation and shall not require routine recalibration throughout its normal service life.

3. Device shall be combined into one device with temperature and humidity sensors, where applicable.

D. Combination CO_2, RH, Temperature Sensors

1. Provide BACnet combination CO2/RH/Temperature measuring devices for mounting where indicated on the plans.

2. Each BACnet combination sensor shall consist of an integrated system of three or more environment sensing functions in a wall mounted package, with an integral microprocessor-based design capable of operating at least two (2) independent sensor nodes per measurement location.

3. BACnet combination sensors shall have an environmental operating range of no less than 32 – 122° F (0 – 50° C) and 0 – 95% RH, non-condensing.

4. CO_2 Sensor Design and Performance:

a. CO_2 measurement shall be accomplished with Non-Dispersive Infrared (NDIR) technology using gold plated optics and diffusion sampling.

b. CO_2 measurement uncertainty shall be no greater than ±75 ppm (or ±7% of Reading <500 ppm and ±7.5% for 800 – 1,200 ppm) at 77° F (25° C) for a CO_2 measurement range of at least 400 – 2,000 ppm.

c. CO_2 measurement stability shall be <2% FS over the expected 15 year life of the typical sensor.

d. Each CO_2 sensor node shall be factory calibrated, shall automatically self-calibrate during operation and shall not require routine recalibration throughout its normal service life.

E. Temperature Sensor, Humidistat Sensor or CO_2 Sensor Guards:

1. Provide heavy duty acrylic lockable guard to prevent damage and tampering.

F. Pressure Sensors / Transmitters:

1. Air Differential Pressure Sensor / Transmitters:

a. Provide zero and span adjustments, measuring probes and display.

b. Sensors / Transmitters shall comply with the following as a minimum:

1) Accuracy: +/- 1% of full scale.

2) Range: Smallest range feasible for the application, but no more than two times the working differential pressure of the system to allow the highest resolution possible.

c. Acceptable Manufacturers: BAPI, Dwyer, Mamac, Setra, Veris Industries.

2. Liquid Differential Pressure Sensors:

a. Three-valve manifold for venting, draining, and calibration; pressure/temperature test ports in lieu of pressure gauges. Wetted parts shall be stainless steel with a silicone fluid-filled diaphragm. Provide span and zero adjustments.

b. Sensors / Transmitters shall comply with the following as a minimum:

1) Signal: Linear 4 to 20 mA or 0-10 VDC signal.

2) Span: No greater than 2 times the working differential pressure of the system to allow the highest possible resolution.

3) Rating: 150 psig, static.

4) Accuracy: 1% accuracy over the entire span.

5) Repeatability: +/- 0.5% at maximum span.

c. Design Make: Veris Industries PWL / PWL2.

d. Acceptable Manufacturers: Mamac, Setra, Veris Industries.

3. Air Differential and Static Pressure Switches:

a. Span shall be no greater than 2 times the measured value to allow the highest possible resolution.

4. Liquid Differential Pressure Switches:

a. Do not use liquid differential pressure switches for run status on pumps. Provide liquid differential pressure switches when pressure sensing is required to determine status.

b. Acceptable Manufacturers and Model Numbers: Barksdale EPD1HAA40, Penn P74.

G. Water Flow Sensors / Transmitters:

1. Water flow sensors shall meet the requirements necessary for use for test and balance duty as defined in the specifications.

2. Service: Sub-Metering.

a. Full building utility meters needed for billing purposes shall be furnished by Cornell Utilities for contractor installation.

3. Type: Magnetic or Ultrasonic.

a. Turbine & Annubar types are not allowed.

4. Acceptable Manufacturers and Model Numbers:

a. Siemens – Sitrans MAG 3100 Electromagnetic.

b. Emerson – Flexim Ultrasonic.

c. Dwyer – Series TUF Ultrasonic.

H. Air Flow Sensors/Transmitters:

1. Air flow sensors shall be Pitot-tube averaging grid or Vortex Shedding type.

a. Fan inlet grids shall be used where possible to measure fan flow. Fan inlet grids shall be provided by the fan vendor, where possible. BMS contractor shall provide fan inlet grid when it is not provided by fan vendor and it shall not block or affect fan efficiency.

b. The use of "golf ball" type airflow probes is not acceptable.

c. The use of combination control damper/flow measurement devices is not acceptable.

2. Duct Mounted Air Flow Sensor:

a. Rectangular: 16 gauge galvanized casing, 8 in. deep, with formed 1-1/2 in. integral 90° connecting flanges.

b. Oval: 18 gauge galvanized casing, 8 in. long between beads with 1 in. connecting sleeve on each end (10 in. overall length). Actual O.D. dimensions are 1/4 in. less than specified duct I.D. dimensions.

c. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

d. Temperature: 350°F continuous operation, 400°F intermittent operation.

e. Humidity: 0-100% continuous operation.

f. Corrosion Resistance: Good salt air, excellent solvent and aromatic hydrocarbon resistance.

g. Element Material: 6063-T5 anodized aluminum.

h. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

i. Acceptable Manufacturers: Accutrol Vortek, Air Monitor, Paragon

3. Fan Inlet Air Flow Stations:

a. Material: 6063-T5 anodized aluminum, galvanized mounting brackets.

b. Accuracy: Within 2% throughout the velocity range of 600 FPM and over, when installed in accordance with published recommendations.

c. Temperature: 350°F continuous operation; 400°F intermittent operation.

d. Humidity: 0-100% continuous operation.

e. Connection Fittings: 1/4 in. compression, suitable for use with thermoplastic or copper tube.

f. Corrosion Resistance: Good salt air and mild acid resistance, excellent solvent and aromatic hydrocarbon resistance.

g. Design Equipment: Paragon Controls FE-1050.

h. Acceptable Manufacturers: Accutrol Vortek, Air Monitor, Paragon

4. Outside Air Flow Station:

a. Material: Element 6063-T5 anodized aluminum and casing 16 gauge G90 galvanized steel.

b. Accuracy: Within ± 0.5% of actual flow through the velocity range of 200 to 12,00 fpm when installed in accordance with published recommendation and within ±5% at a velocity of 100 fpm. Operating velocity range 100 to 2,800 fpm.

c. Temperature: 350°F continuous operation and 400° intermittent operation.

d. Humidity: 0 to 100%.

e. Acceptable Manufacturers: Air Monitor, Paragon

5. Air Volume/Velocity Transducers for Duct, Outside Air and Fan Inlet Airflow Stations:

a. The transducer shall be a combination differential pressure transmitter, square rood extractor, scaling multiplier, and output filter with process indication, complete in a single package Transducer shall comply with the following as a minimum:

1) Accuracy: +/- 0.25%.

2) Stability: +/- 0.5% of full scale per year or less.

3) Span: No greater than 2 times the working differential pressure of the system to allow the highest possible resolution.

4) Material: Compatible with the environment.

5) Auto-zero capability by venting ports to atmosphere.

b. The measured air volume shall be locally indicated on a door mounted LED display meter scaled in CFM.

c. The transducer package shall be a factory calibrated for the flow-measuring element being served.

d. A transducer shall be provided for each individual airflow station.

e. An output signal of 0-10 VDC or 4-20 mA shall be generated for monitoring by the BACS system.

f. Acceptable Manufacturers: Accutrol Vortek, Air Monitor, Paragon.

I. Current Switches (CS):

a. For constant speed motors, switch shall indicate loss of status when current falls below an adjustable trip point.

b. CS shall include LED indication of status.

c. Acceptable Manufacturer: Veris Industries.

J. Explosion Proof Audio Alarm:

a. For Class I, Division I hazardous locations.

b. Operates on 25 or 70 Vrms signal lines.

c. Power Input: 7W.

d. Indoor Use and NEMA 3 rated.

e. Acceptable Manufacturer: Potter or approved equal.

K. Explosion Proof Strobe Light:

a. For Class I, Division I hazardous locations.

b. Voltage: 24 VDC.

c. Wall mounted with dome guard.

d. Flashes per Minute: 80

e. Acceptable Manufacturer: Potter or approved equal.

L. Occupancy/Vacancy Sensors:

1. For spaces with standalone lighting controls, the sensors are to be provided by the electrical trade to control both HVAC and lighting; The BACS contractor shall provide a single gang box with face plate at the sensor. Refer to the Lighting Controls Responsibility Chart in Part 3.

M. BACS Lighting Control Sensors:

1. Certain zone types require that the BACS perform the lighting controls. Refer to Division 26 specifications for the product requirement and refer to the Lighting Controls Responsibility Chart in Part 3.

N. Condensate Sensors:

1. Condensate Sensors for moisture sensing on chilled water supply systems to terminal chilled beam and radiant cooling devices.

2. Acceptable Manufacturers and Model Numbers:

a. Siemens QXA 2000

b. Sauter EGH 102

c. Honeywell H7018A1003

A. Safety/Status Devices:

1. Low Limit Detector: Electric type, with 20 ft. long serpentine element, with manual reset and auxiliary contacts to the BACS, set for 37°F for "freeze" protection and 55°F for fan discharge application. Provide a 20 ft. long element for every 25 sq. ft. of coil face area.

2. High Limit Detector: High limit thermostats shall be located as directed, and shall be manual reset type set at 120°F in the return and 180°F in the discharge. Thermostats shall be double pole so as to provide input capability for alarm at the temperature control system.

3. Pump status shall be provided through adjustable range current sensing element on pump motor.

4. Fan status shall be provided through adjustable range current sensing element on the fan motor.

B. Miscellaneous Devices:

1. Provide necessary, relays, transformers, required for a complete and operable system.

2.2 CONTROL VALVES

A. General:

1. Sized by BMS Contractor/Subcontractor and guaranteed to meet the heating and cooling requirements. Pressure drop for valves shall be submitted for review, including all CV values. Valves shall be selected such that they are not oversized.

2. Valves shall be suitable for the rated pressure and temperature service. Close off pressures must be determined in concert with the actuators and valves shall be provided to close off against extreme anticipated conditions.

3. Modulating valves shall be carefully selected to control in a smooth and stable fashion across the range of anticipated conditions. Split ranging of heating and cooling valves controlled by the BACS is not acceptable. A separate output from the BACS shall be provided for all control valves. Electric Input shall be 4-20 mA or 0-10 VDC.

4. Pressure independent control valves shall not be used.

B. Electrical Operators:

1. Provide 24 VAC control operators which are 0-10 VDC input proportional with fail positions as noted below and as needed by control sequence. Operator shall be synchronous motor driven with sufficient reserve torque to provide smooth modulating action.

2. Actuators shall be electric, one motor only. When stacking of actuators is deemed necessary, actuator shall be submitted for review by engineer of record and owner.

3. Acceptable Manufacturer: Belimo

C. Chilled Water Recirculating Loop Valve (Two-Way):

1. Type: Rotary-segmented ball ported industrial control valve.

2. Body: Flanged carbon steel.

3. Seat: Composition or stainless/ teflon.

4. Leakage Class: ANSI Class IV, minimum.

5. Trim: 316 stainless steel.

6. Flow Characteristics: Equal percentage or modified equal.

7. Typically CV shall be selected to give a 2 PSIG drop @ maximum building flow with the valve at the 90% open CV. Verify the necessary pressure drop with the engineer and Cornell University Department of Utilities and Energy Management (Utilities). For buildings located at extremities, requirements may not be typical.

8. Valve shall seat against 40 PSI differential pressure (typical value; check with Cornell Utilities for location specific values).

9. Fail Position: Fail Last

10. Acceptable Manufacturers: Belimo, Fisher, Neles, Valve Solutions, Inc.

D. Coil Valves, Water:

1. Type: Two-way, V-port valve with characterizing disc, 1/4 turn.

2. Packing: EPDM O-rings, lubricated.

3. Ball & Stem: Stainless steel.

4. Seat: Fiberglass reinforced teflon.

5. Flow characteristics: Equal percentage

6. Modulating water valves will generally be ball valves with an equal percentage characteristic. Modulating water valves shall typically be sized for 50-100% of the typical controlled circuit pressure drop at 70% wide open CV. The minimum design CV shall be no less than 1.9.

7. Water and glycol control valves shall be rated to remain closed (zero leakage) against 120% of the full shutoff head of the pumps, when the control signal is set to "fully closed".

8. Fail positions shall generally be as follows:

a. Terminal Hot Water Radiation: Fail last.

b. Duct Mounted Re-heat Coils Serving Offices: Fail last.

c. Fan Coil Unit Cooling Coils: Normally closed, spring return.

d. Pre-heat Coils in Air Handling Units: Normally open, spring return.

e. Chilled Water Coils in Air Handling Units: Normally closed, spring return.

9. Acceptable Manufacturers: Belimo, Valve Solutions, Inc.

2.3 CONTROL DAMPERS

A. General:

1. Dampers shall be applicable for the rated pressure and velocity service. Damper structural rating shall exceed extreme anticipated conditions like fan deadhead.

2. Where damper sizes are not specifically indicated, they shall be sized by the BACS Contractor. Maximum velocity shall be 1500 fpm and maximum pressure drop 0.1 in. w.g.

3. Modulating dampers shall be carefully selected to control in a smooth and stable fashion across the range of anticipated conditions.

4. Except where size dictates a single blade, dampers shall always be opposed blade.

5. When a large section of damper is to be connected to a single jackshaft, size limitations shall be followed. This will prevent excessive damper area or, more importantly, length from being connected to a single jackshaft. Typically, the manufacturer's recommendation shall be sufficient for specifying a limit to the size of a damper bank that may have field fabricated jackshaft connections.

6. Whenever possible, dampers shall have external crankshafts to allow the connection of the damper actuator outside of the air stream. This will allow for easier access to the actuators for maintenance.

7. Output to modulating control dampers shall be analog.

B. Electrical Operators:

1. Provide 24 VAC control operators which are 0-10 VDC input proportional or two position with spring return as needed by control sequence and designed to operate the control dampers. Operator shall be synchronous motor driven with sufficient reserve torque to provide smooth modulating action or two position action and adequate close off rating.

2. Actuators shall be electric, one motor only. Stacking of actuators is unacceptable. Design for a minimum of 60,000 full cycles at full torque and listed to UL 873. Provide stroke indicator. Actuators shall have a positive positioning circuit and selectable inputs. Full stroke shall be within 90 seconds. Where fail positions are required, provide spring return on the actuator with adequate close off force.

3. Acceptable Manufacturer: Belimo

C. General Duty, Control Dampers:

1. Provide control dampers as shown on the drawings and diagrams, to meet the following minimum construction standards.

2. Leakage: Class 1, 4 CFM/sq. ft. at 1 in. W.C., tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage.

3. Frame: 16 gauge galvanized steel structural hot channel with tabbed corners for reinforcement to meet 13 gauge criteria.

4. Blades: 14 gauge (equivalent thickness galvanized steel) roll forward air foil type for low pressure drop and low noise generation. Blades shall be parallel for two-position dampers and opposed, for modulating dampers.

5. Blade Seals: Ruskiprene, suitable for -72°F to +275°F mechanically locked into the blade edge.

6. Jamb Seals: Flexible metal, compression type.

7. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.

8. Bearings: Corrosion resistant, permanently lubricated stainless steel sleeve.

9. Dampers subject to corrosive fumes or humidity shall be constructed of stainless steel.

10. Dampers over 48 in. length and height shall be made in multiple sections.

11. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package.

12. Design Make: Ruskin CD60.

13. Acceptable Manufacturers: Greenheck, Ruskin and Tamco.

D. High Performance Thermally Broken and Insulated Control (Motorized) Dampers:

1. Provide high performance thermally broken and insulated control dampers at outdoor air intake and exhaust louvers to meet the following minimum construction standards.

2. Leakage: Shall not exceed 4 CFM/sq. ft. at 1in. W.C. (Leakage Class 1), tested per AMCA Standard 500-D-98 and AMCA Standard 511 and bearing AMCA's Certified Ratings for both air performance and air leakage. Holding torque shall not exceed 5 in. lbs./sq. ft. on opposed blade dampers, and 7 in. lbs./sq. ft. on parallel blades with a minimum torque of 40 in. lbs.

3. Frame: 0.125 in. extruded aluminum structural hat channel with tabbed corners for reinforcement.

4. Blade Seals: Ruskiprene II, suitable for -40°F and with locked into the blade edge extruded silicone, down to -70°F.

5. Jamb Seals: Flexible polycarbonate type.

6. Blade Axles: 1/2 in. plated steel hexagonal positively locked into the damper blade. Linkage conceded out of the air stream.

7. Bearings: Corrosion resistant, permanently lubricated molded synthetic.

8. Dampers over 48 in. length and height shall be made in multiple sections.

9. Where shown or required for proof of closure or open position, provide factory installed damper positioning switch package.

10. Design Make: Ruskin TED50.

11. Acceptable Manufacturers: Greenheck, Ruskin and Tamco.

2.4 CONTROL PANELS

A. Enclosures:

1. BACS control panels shall be fully enclosed cabinet, baked enamel, steel, aluminum or composite material construction. Enclosures located in mechanical rooms shall be NEMA 4 and Enclosures located in labs and other relatively dust free and dry spaces may be NEMA 1. Enclosures shall have removable back plates and keyed, hinged covers. Enclosures shall be either free-standing or wall-mounted. Provide support steel framing.

2. The Contractor shall size the panel such that no more than 80% of the surface of the enclosure back plate is used.

3. Network level boards shall be installed inside a protective enclosure.

4. Plastic wire way (e.g., Panduit) shall be used to organize all wiring in the panel. Sufficient wire way shall be provided in the panel such that it is filled no more than 80% capacity.

5. Cover exposed electrical connections. Each component on front panel shall have an appropriate engraved label describing its function. Components inside the panel shall be appropriately labeled for ease of identification. Stick-on labels are not acceptable.

B. Low Voltage Power Supplies:

1. The Contractor shall provide a regulated, protected low voltage power supply as required with the ability to produce at least 33% more current than required by the transmitters and controls being installed. Output regulation shall be less than 0.5mV. There shall be no overshoot on turn on or off. Operating temperature shall be -20 to +70ºC.

2. Class II transformers shall be used.

C. Line Voltage Power Source:

1. Careful consideration must be given to the propagation of information across controllers as they wake up from a power interruption. This may require certain critical controllers to be powered from uninterruptible power source (UPS) to ensure rapid propagation of the emergency status.

2.5 CONTROL WIRING AND INSTRUMENTATION TUBING

A. All control wiring shall comply with requirements of “Electrical Wiring” in Section 230504.

B. All instrumentation tubing in mechanical rooms shall be hard drawn type L copper.

2.6 CONTROLLERS

A. The control system shall consist of a network of controllers. It is intended to allow cost-effective application of manufacturers' standard products while maintaining the integrity and reliability of the control functions commensurate with their application. The controllers provided shall meet the performance requirements for throughput, response time, point capacity, trend log capacity, etc., as stated in this section and Section 230901. While specification 230901 contains several constraints on the controller system architecture, it is recognized that a variety of configurations may be equally acceptable. For example, it may be possible to meet the project requirements with a single large controller or several smaller ones. Therefore, this guideline does not generally prescribe controllers' system architecture or controllers' detailed characteristics, such as processor speed, amount of memory, amount of I/O, power supply details, etc.

B. Controllers shall be provided with a real-time operating system resident in ROM. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. At a minimum, the following shall be provided:

1. Real-time operating system software.

2. Real-time clock/calendar and network time synchronization (with the exception field-level controllers).

3. Controller diagnostic software.

4. BACS software.

5. Alarm processing and buffering software.

6. Energy management software.

7. Data trending, reporting, and buffering software.

8. I/O (physical and virtual) database. Inputs and outputs shall have the capability to be overridden for emergency modes and testing. If the design documentation does not specifically indicate for which points this is required, control vendor shall request in writing a list of such points. If this has not been requested, the vendor shall reprogram or reconfigure the systems as required during testing.

C. Building and system level controllers (for example, air handling units, hydronic systems, laboratory zones) shall be capable of operating independently, in stand- alone fashion, with no communication to other devices on the network while performing their monitoring and control routines using programs and operating parameters stored in the controllers' memory. All points and functions that make up a functional system shall be included in one controller to qualify for this stand-alone functionality. Refer to control schematics for function point groups. Examples of required functional point groupings, by owner, are as follows:

1. Air Systems: All points and functions required to control an air handler with all directly associated supply fans, return fans, exhaust fans, airflows, heat recovery, coils and downstream static pressure sensors.

This excludes the terminals that may be associated with that air handler.

2. Hydronic Systems: All points and functions associated with the supply side of a hydronic system such as pumps, flow meters, temperature sensors, differential pressure sensors, proof indications, valves etc. This excludes the terminals on that hydronic system.

3. Terminals: All points and functions required to control one terminal system including variable airflow devices, control dampers, valves, temperature and humidity sensors, etc. This does not include the scheduling period or any outside air that may be necessary for control.

D. Where control sequences depend on global variables such as outside air temperature, the controller shall have the capability of either using the last value or a default value.

E. Values that may be received across the network are as follows:

1. Air Systems: Outside air temperature and humidity, emergency power source indications, terminal based reset parameters, VAV box commands, smoke modes.

2. Hydronic Systems: Outside air temperature and humidity, emergency power source indication, and terminal based reset parameters, control valve commands.

F. Controllers must include sufficient memory for all required operation and all required trending, when trending is buffered in the controller. Where control system operation is hindered by the shortage of memory, contractor shall, at no cost to the Owner, either upgrade the memory or provide multiple controllers. The mix of points for multiple controllers shall not violate the stand-alone requirements.

G. Controllers storing their configuration in volatile memory shall not be used. Software stored in non-volatile memory will not have to be downloaded from the central server after an interruption of power occurs.

H. Controllers used for time-scheduled operations must be equipped with a battery backed internal real-time clock function to provide a time base for implementing time-dependent programs. Provision shall be made for the automatic updating, such as a Network Time Protocol (NTP) server or Precise Time Protocol (PTP) server, of the controllers' clocks via a time master.

I. Resumption of power after an outage shall cause the controllers to automatically restart and establish communications as needed by their applications.
Controller shutdown based on a self-diagnosed failure in the power supply, hardware, or software must set each piece of controlled equipment to a predetermined failure mode.

J. Controllers shall be powered from the most reliable source that powers any of the systems it serves. In the situation where a controller will be required to continuously collect data, or where it monitors critical recovery information such as the presence of emergency power, it may be necessary to provide a UPS for the controller as well as any critical sensors.

Where panels are provided with a UPS, the panel shall be provided with a means of monitoring the power source status to the controlled equipment to enable special emergency power logic. This can be a dedicated power monitor or a value coming from transfer switch contacts.

K. Controllers shall be powered from the most reliable source that powers any of the systems it serves. In the situation where a controller will be required to continuously collect data, or where it monitors critical recovery information such as the presence of emergency power, it may be necessary to provide a UPS for the controller as well as any critical sensors. Where panels are provided with a UPS, the panel shall be provided with a means of monitoring the power source status to the controlled equipment to enable special emergency power logic. This can be a dedicated power monitor or a value coming from transfer switch contacts.

PART 3 – EXECUTION

3.1 GENERAL SYSTEM REQUIREMENTS

A. This section defines the requirements for configuration and installation of the BACS.

B. Vendors providing controls for Cornell University shall maintain site-wide configuration documentation. Whenever the BACS is extended, the documentation required in this section shall be provided/updated per configuration management requirements to reflect the entire installation on the campus. Device naming and addressing must conform to Cornell's specific conventions as detailed in Cornell's specific convention as detailed in Specification 230901. No device will be connected to a Cornell network until these conventions have been understood and met.

C. Devices (i.e., sensors, meters, instruments, etc.) that are resettable must be installed in a readily accessible location (e.g., the device must be accessible at floor level without the use of a ladder). No device shall require shutting down a building system for calibration.

D. Devices that are installed in an exposed location (i.e., not mounted within a cabinet) must be suitable for such installations (e.g., do not install a device that is intended to be installed in a cabinet in an exposed location).

E. Remove all obsolete pneumatic tubing and control devices.

3.2 SENSORS

A. Room Sensors shall be mounted symmetrical with adjacent items such as light switches (nominally 44 inch to the center of the device and in accordance with ADA requirements). Verify exact room location to avoid doors, fixed and portable equipment. Install to minimize damage. Do not install adjacent to lighting dimmers or other heat generating equipment.

B. All sensors and transmitters shall be located in accessible locations that do not require system shutdown for calibration. Locate all remote transmitters in control panels 5 foot above finished floor.

C. One outside air (OA) temperature / humidity sensor with a global networked point provided for each building. Generally, these shall be located on a north wall of the building and installed with stand-offs. On each 100% OA system, locate sensor with dewpoint calculations in outside air intake plenum.

D. Refer to drawings for installation requirements for liquid differential pressure sensors.

E. All pressure switches shall be mounted in accessible and, to the extent possible, vibration-free locations. Switches shall be installed in accordance with the manufacturer's installation instructions.

F. Do not use liquid differential pressure switches for run status on pumps. Current switches shall be used on constant volume pumps and drive contacts shall be used for pumps with VFDs.

G. Flow sensors shall be carefully placed to ensure flow profiles that are required for accurate flow sensing. Installed in accordance with the manufacturer's installation instructions for minimum length of duct or pipe unobstructed upstream and downstream from the sensor.

3.3 CONTROL VALVES

A. Union or flanged connected. Locate close to apparatus controlled with pipe reducers and increasers located closest to valve. Locate, arrange, and pipe per installation diagram.

3.4 CONTROL DAMPERS

A. Dampers and Damper Operators: Tag dampers for proper location. Install per manufacturer's printed instruction as to motor size and quantity, linkage arrangement, drive connection point. Adjust to close tightly. Allow for conduit sleeve or blank space for roof fan dampers. Where ducts are insulated, set damper operators at least 2 in. away from side of duct to allow for insulation.

3.5 CONTROL PANELS

A. The control panels and enclosures housing the controllers shall be coordinated to the extent possible, to share vertical and horizontal wire-ways to facilitate and minimize the cost of home-runs to terminal equipment.

B. Cornell must have quick, direct access to all control panels to maintain building integrity similar to that provided for fire emergencies without going through user spaces. Panels shall be located outside of user areas where practical. If field panels must be located in user areas, they shall be in areas with easy access. Protection and separation for user activities will be provided.

C. Enclosures:

1. All BACS mechanical room control panels shall be installed in metal enclosures containing the controller, I/O modules, power supplies, termination strips, battery (if not integral to the controller or I/O module) and a spare AC outlet.

2. Control panels shall be located in the equipment rooms, where practicable, and in locations such that the ambient conditions are between 50 and 90°F and 10 to 85% relative humidity. Control panels located in areas where conditions are outside of these ranges shall have enclosures outfitted with heating or cooling devices to provide the proper environmental conditions.

3. All terminal controllers shall be installed in a protective sheetmetal enclosure. Coordinate with the terminal unit vendor.

4. All penetrations of the BACS or outboard gear panels in mechanical rooms shall be from the bottom of the enclosure with wireway and conduit stubs from the wireway up to the panel.

5. Panel layout and construction shall be neat and professional.

6. All controllers, wiring, and components in the panels shall be labeled. All labeling shall match the reference numbers on the cabinet drawings that shall be provided for each panel.

7. All transformers and power supplies shall be mounted outside of the central panel.

D. Low Voltage Power Supplies:

1. The BACS Contactor shall certify, in writing, at the time of shop drawing submittal that the BACS equipment provided will not cause, as a result of its operation, either directly or indirectly, electrical interference to be induced into the building's electrical power systems.

E. Live Voltage Power Source:

1. Controllers shall be powered from emergency power sources whenever the controlled equipment is connected to emergency power source.

2. An un-interruptible power source (UPS) shall be provided on Ethernet network gateways (headends) and switches.

3. Line voltage power sources to controls shall be labelled with its source panel and circuit number.

3.6 CONTROL WIRING AND INSTRUMENTATION TUBING

A. All control wiring shall comply with requirements of "Electrical Wiring" in Section 230504.

B. It is extremely important that pneumatic tubing be properly terminated.
Tubing shall be removed completely back to the main. Copper tubing shall be terminated with soldered end cap; poly tubing shall be terminated using brass plugs. Bending over copper tubing, pinching/brazing, and the use of sheet metal screws to make terminations are not acceptable.

3.7 CONTROLLERS

A. The controllers and system architecture shall be configured and programmed to carry out the sequences of operation contained in the project documents.

B. Since these guidelines with respect to controllers are performance oriented, rather than prescriptive, they will generally refer simply to "controllers" meaning computers capable of direct digital control. In those cases where distinguishing between controllers with differing capabilities is needed, the following nomenclature will be used:

1. Building-level controller: These are controllers that are connected to the campus backbone network and communicate over Ethernet using BACnet/IP. They will typically be used to control and monitor one or more large systems or be applied to other building-wide functions. They shall, at a minimum, meet the requirements of a BACnet Building Controller (B-BC).

2. System-level controller: These controllers will also be BACnet/IP connected to the campus backbone network. They will typically be dedicated to the control of a single large piece of equipment such as an air handler or chiller, and a lab environment with fume hoods. They shall, at a minimum, meet the requirements of a BACnet Advanced Application Controller (B-AAC).

3. Field-level controller: These controllers are typically used for control of "unitary" devices such as VAV boxes, fan coil units, etc. These controllers will be BACnet/IP connected to the campus backbone network or in special spaces may be on a lower performance BACnet LAN such as MS/TP or ARCNET. They shall, at a minimum, meet the requirements of a BACnet Application Specific Controller (B-ASC).

C. Controllers: Controllers shall be provided with a real-time operating system resident in ROM. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. At a minimum, the following shall be provided:

1. Real-time operating system software.

2. Real-time clock/calendar and network time synchronization (with the exception field-level controllers).

3. Controller diagnostic software.

4. BACS software.

5. Alarm processing and buffering software.

6. Energy management software.

7. Data trending, reporting, and buffering software.

8. I/O (physical and virtual) database. Inputs and outputs shall have the capability to be overridden for emergency modes and testing. If the design documentation does not specifically indicate for which points this is required, control vendor shall request in writing a list of such points. If this has not been requested, the vendor shall reprogram or reconfigure the systems as required during testing.

D. Programming: The programming shall be logically segmented, documented, and titled, and expand on the specified sequence of operations. Each segment shall contain control logic for a specific controlled component of a system. This is to improve the ability of the end user to understand and interpret the logic easily.

E. Trending: To support commissioning and building data mining, the BACS shall be capable of trending and archiving all points on building-level and system-level controllers at a minimum of 15 minute intervals. The BACS shall also have the capability of trending at least five points on each field-level controller at an interval of 15 minutes. The trend data shall be uploaded to a central database as needed to prevent buffer overflow in the controller. Controller memory capability, network architecture, and communications bandwidth shall be designed to account for this trending. The BACS vendor shall provide control trends during start up and prior to functional performance testing of the systems. Reports shall be scheduled to output the data to a common format such as comma separated text, Microsoft formats such as Excel and Access, and portable database format. Trended data will be archived in an Owner-accessible SQL database for a minimum period of 2-years.

F. Trend Graphs: Web-based software shall provide for displaying graphic plots of the trended values. The software shall support multiple scales, points and point types simultaneously. Control vendor shall configure these graphs in a logical manner for each system. Consult with the commissioning team members and project manager for required configuration. Provide a trend for every analog control loop that includes the setpoint, process variable, and control output.

G. Real-time Plotting: Software shall be provided for real time plotting/graphing of multiple values in user-defined time intervals. These graphs will typically be used in commissioning to observe loop responses and system reactions. Control vendor shall configure these graphs in a logical manner for each system. Consult with the commissioning team members and project manager for required configuration.

H. Web-based Graphic: The following screens shall be provided:

1. Floor Plan Screens:

a. Provide floor plan screens for each floor and/or section of the building. Indicate the location of all equipment that is not located on the equipment room screens. Indicate the location of temperature sensors and the device associated with each temperature-controlled zone (i.e., reheat coils, VAV terminals, fan-coils, single-zone AHU's etc.) on the floor plan screens. Each floor plan screen shall show thermographic space temperatures and lighting on/off status.

b. Display the space temperature point adjacent to each temperature sensor symbol. Indicate room numbers as provided by Cornell University.

Provide a graphic link from each zone and/or equipment symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.

c. Provide floor plan screens for each mechanical equipment room and, if mechanical equipment is situated there, the roof. Indicate the location of each item of mechanical equipment. Provide a link from each equipment symbol shown on the plan view screen to each corresponding mechanical system schematic graphic.

d. If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views and/or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link the graphic building key plan to larger scale partial floor plans. Provide links from each larger scale floor plan graphic to the building key plan and to each of the other graphic floor plan screens.

e. Provide a graphic site plan with links to and from each building graphic.

f. Locate central system static and differential pressure sensors, linkable from the floor plan drawings.

2. System Schematic Screens:

a. Provide graphics for each air handling system. Indicate OA temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down, etc.). Link screens for air handlers to the heating system and cooling system graphics Link screens for supply and exhaust systems, if they are not available in a single graphic.

b. Each I/O point in the project shall appear in at least one graphic. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc., as applicable. General layout of the system shall be schematically correct. I/O devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the cursor. Indicate all adjustable setpoints on the applicable system schematic graphic or, if space does not allow, on a supplemental linked setpoint screen. All outputs shall be represented in terms of percent open and include a pop-up link to the control logic.

c. Provide a system schematic graphic for each HVAC subsystem controlled.

d. Provide a graphic for each hydronic system.

e. Link screens for heating and cooling system graphics to utility history reports showing current and monthly energy usage, demands, peak values, etc.

f. Link screens to all schedules and setpoints.

3. Zone Schematic Screens, HVAC:

a. Provide a graphic for each zone, including all terminal units such as fan coil units, chilled beams and VAVs shown on the graphic even if provided with different terminal level controllers.

b. In addition to points associated with the unit, indicate mode of operation as applicable (i.e., normal occupied, unoccupied, warm-up, maximum heating, maximum cooling, etc.). Provide links between the applicable floor plan screen and this screen.

c. Provide links to the graphics representing the parent systems.

4. Zone Schematic Screens, Lighting Controls:

a. Provide a graphic for each zone. Provide links between the applicable floor plan screen and this screen. Refer to Cornell University Standard, 260923 for additional requirements.

I. Alarm Programming: Alarms shall be intelligent based upon the algorithm in this section

1. Alarm programming related to BACS controlled equipment shall reside at the controller level along with the functional programming for equipment control.

a. Intrinsic alarming associated with AI, AV, BI or BV objects (or any of the other BACnet objects that support intrinsic alarming) shall only be used where the alarm is valid regardless of the state of the associated equipment or where there is a ready means for automatically suppressing alarm generation when the associated equipment is operationally secured.

b. Alarm points shall be separate BACnet objects actuated by associated alarm programming.

c. Alarm objects shall have descriptive BACnet object names. BACnet alarm object names shall end in “Alarm”. For detailed information on proper point naming conventions, see Section 230901 Building Automation and Control System Communications and Interoperability.

d. If it is necessary for the alarm to have latching functionality, the user shall be provided easy unlatching capability from within the BACS if appropriate, taking into account equipment safety concerns. This is in addition to any local alarm reset.

e. Alarms designated for monitoring by EMCS shall be set up in the BACS to report to the EMCS alarm server.

f. Generally, only central system alarms shall be annunciated at EMCS. Zone and or equipment alarms shall be considered on a case by case basis.

2. Analog Deviation Alarms: Analog deviation alarms shall be based upon the comparison between the controlled variable and the controlled variable setpoint (whether calculated or fixed).

a. When controlled variable deviates from setpoint above or below user adjustable high or low alarm thresholds, the alarm shall be activated.

b. High and low alarm threshold values shall have associated adjustable deadbands (hysteresis values) for alarm clearing conditions as the controlled variable falls below the high alarm threshold or rises above the low alarm threshold.

c. Alarm programming shall include user adjustable alarm delays for active equipment operation.

d. Alarm programming shall include startup delays to prevent nuisance alarms during equipment startup.

e. Analog deviation alarms shall be disabled if the associated equipment is operationally secured.

3. Analog High Limit Alarms: Analog high limit alarms shall be based upon the comparison between the controlled variable and a user adjustable high limit alarm value.

a. When controlled variable rises above the user adjustable high limit, the alarm shall be activated.

b. High alarm limit value shall have associated adjustable deadband (hysteresis value) for alarm clearing condition as the controlled variable falls below the high alarm limit.

c. Alarm programming shall include user adjustable alarm delays.

d. High limit alarms shall be disabled if the associated equipment is operationally secured, unless needed due to equipment safety considerations.

4. Analog Low Limit Alarms: Analog low limit alarms shall be based upon the comparison between the controlled variable and a user adjustable low limit alarm value.

a. When controlled variable falls below the user adjustable low limit, the alarm shall be activated.

b. Low alarm limit value shall have associated adjustable deadband (hysteresis value) for alarm clearing condition as the controlled variable rises above the low alarm limit.

c. Alarm programming shall include user adjustable alarm delays.

d. Low limit alarms shall be disabled if the associated equipment is operationally secured, unless needed due to equipment safety considerations.

5. Binary Run Status Alarms: Status alarms shall be based upon the comparison between run status and equipment command where applicable.

a. Alarm Status programming shall include user adjustable alarm delays.

6. Binary Alarming: Alarms shall be triggered upon associated BI changing state to the non-normal or alarm state.

a. Alarm Status programming shall include user adjustable alarm delays.

b. Binary alarms shall be disabled if the associated equipment is operationally secured, unless needed due to equipment safety considerations.

3.8 OPERATOR INTERFACES

A. All interface to the BACS shall be web-based.

B. During construction, the BACS shall be hosted on a construction server and transferred to the owner's central server at the earliest convenience.

C. The project shall be responsible for upgrading the campus central server location.

3.9 LOW AND HIGH LIMIT SAFETY FUNCTIONS

A. Provide for where noted on drawings. Wiring to be directly to the motor starter. High limit controller (firestat) shall be located in the unit discharge. Low limit shall be strung on the upstream face of cooling coils.

3.10 SMOKE DAMPERS AND FIRE/FAN SHUT DOWN

A. Provide control for smoke dampers as required. Division 26 "Electric" to provide 120 volt power wiring and associated signal wiring to close all smoke partition smoke dampers associated with a particular air handling unit upon alarm at any duct smoke detector in that particular system. Coordinate the voltage of the EP switch with Division 26 "Electric".

B. Division 26 "Electric" to provide a signal to stop air handling unit fans and close air handling unit smoke dampers upon activation of the fire alarm system. Wiring to be directly to the motor starter.

C. The BACS Contractor shall provide control wiring for a digital input point for an end switch that shall prevent the operation of the air handling unit fans until its corresponding smoke dampers are proven fully open.

D. Division 26 "Electric" shall also provide a signal to the BACS control system that the fire alarm system is activated.

E. Installed Smoke Detection Devices and Smoke Dampers:

1. Smoke dampers are installed at each duct/smoke barrier penetration.

2. Every smoke damper has a local duct smoke detector.

3. Every smoke damper has a local remote test station.

4. Every duct smoke detector is addressable and is connected to the building fire alarm system.

5. The building project area is provided with addressable area smoke detectors.

F. Fire Alarm Activation of Smoke Dampers:

1. Duct Smoke Detectors:

a. Upon activation of any duct smoke detector, an addressable signal is sent to the building fire alarm system and the smoke damper associated with duct smoke detector is closed.

b. Upon receipt of the addressable duct smoke detector signal, the building fire alarm system shuts down both the supply and return fans or the exhaust fan, associated with the duct system that experienced the detector activation.

c. Upon receipt of the associated fan system drives being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

G. Non-Fire Alarm System Activation of Smoke Dampers (These activations do not cause for a building fire condition to be annunciated):

1. Safety Device Activation:

a. Upon activation of either the low-limit switch (freeze-stat) or the supply duct high static pressure switch, both the supply and return fans are de-energized via hardwiring of the low limit switch in the fan starter circuits.

b. The building fire alarm system point addressable module that is installed at the variable frequency drive of the supply and return fans then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated fan system drives being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

2. BACS (Building Automation Control System) Component Fault:

a. Upon activation of any of the following BACS component faults, the supply and return fans, or exhaust fan are de-energized via BACS.

1) Supply fan motor fault

2) Return fan motor fault

3) Exhaust fan motor fault

4) Exhaust fan current sensor fault

5) Outside air damper end switch fault

6) Return air damper end switch fault

7) Exhaust air damper end switch fault

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

3. EMCS Operator Activation:

a. When the EMCS system operator overrides the operational status of the air handling system and shuts down the supply, return, or exhaust fans.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through BACS programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

4. Maintenance Operator Activation:

a. When a building maintenance staff member manually shuts off the supply, return or exhaust fan at the starter disconnect switch, the supply, return or exhaust fans are shutdown.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through BACS programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

H. Smoke Damper Testing – Salas O'Brien Consulting and Engineering Group of New York, Inc. (FKA M/E Engineering) offers the following suggestions for a smoke damper testing protocol. The actual final protocol needs to be authored and approved by all Cornell parties and agencies of interest.

1. Duct Smoke Detector (Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager and Cornell Fire and Safety, apply smoke to any duct smoke detector in the ductwork of any air handling systems which serve the project area.

b. Upon receipt of the addressable duct smoke detector signal, the building fire alarm system shuts down both the supply and return, or exhaust fans associated with the duct system that experienced the detector activation.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

2. Safety Device Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually trip the low limit switch (freeze-stat) associated with any air handling system in the project area.

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

d. Confirm damper closure at the local smoke damper access door.

3. BACS Component Interlock or Fault:

a. Under controlled conditions and with proper notification to the Building Manager, manually cause for a fault condition to occur in any of the following BACS components:

1) Supply fan VFD fault

2) Return fan VFD fault

3) Exhaust fan VFD fault

4) Exhaust fan current sensor fault

5) Outside air damper end switch fault

6) Return air damper end switch fault

7) Exhaust air damper end switch fault

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

d. Confirm damper closure at the local smoke damper access door

4. EMCS Operator Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually override the operational status of any air handling system via laptop, PC or remote access to EMCS Webcontrol and shutdown the associated air handing system.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through BACS programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

5. Maintenance Operator Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually shut off any air handling system within the project area.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through BACS programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

3.11 COMMISSIONING

A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems meet the Owner's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.

B. All new BACS installations and expansions of existing systems shall be fully commissioned. All acceptance testing, documentation and training shall be required.

C. The BACS Contractor's responsibilities for commissioning and check-out include the following:

1. Ensure that the start-up, testing, adjusting, and balancing of systems and equipment has been completed prior to field commissioning.

2. Provide all logic, graphics, and trends for review prior to the start of field commissioning activities.

3. Provide a complete calibration and operational check for each individual point and function contained within the BACS.

4. Conduct the checkout with the use of point/function log sheets to be prepared by the contractor. The Owner shall approve the log sheet format.

5. Submit log sheets to the Owner prior to the commencement of any final acceptance testing.

6. Certify, in writing, to the Owner prior to the commencement of final acceptance testing that all components of the BACS are functioning as per the requirements of the contract documents.

7. Provide to the Owner as-built drawings and documentation at least four (4) weeks prior to the commencement of any final BACS acceptance testing. Ensure all trends and graphics are completed and approved by Cornell.

8. The BACS contractor shall issue a report upon project completion stating that the system is complete, has been adjusted, and has had all hardware and software functions verified, that all analog control loops are tuned, and is operating in accordance with the specifications. Any deviations from specified settings or operations necessitated during system adjustment shall be specifically noted.

9. The Contractor shall check out the installation with a representative from Cornell's Energy Conservation Control Team. The checkout shall consist of verifying the ability of the BACS to communicate with the central EMCS system, verifying the calibration of each sensor and/or transmitter, and verifying the operation of each control point.

10. All software processes shall be thoroughly demonstrated to the Owner's representative. Alarm conditions shall be simulated for conformance. Analog control points shall be exercised through their entire range. All control interlocks and sequences shall be completely verified. The checkout shall be a thorough and exhaustive review of the installation to assure proper operation of the total system.

3.12 TRAINING

A. Upon completion of the work and acceptance by the Owner, factory representatives of the control manufacturer shall provide instruction to the Owner's operating personnel who have responsibility for the mechanical systems and controls installed by the contractor. The contractor shall provide 56 hours of training.

B. The contractor shall make available to the Owner regular, scheduled training courses for ongoing training of the Owner's operating personnel. Programs shall include hardware- and software-oriented courses as well as energy conservation and management courses.

C. In addition to the normal training listed above, vendors will be required to provide one week of training at the BACS manufacturer's training facility for four people**.**

3.13 CONTROL SEQUENCE

A. Refer to plan for control diagrams, sequence of operation and points lists.

3.14 LIGHTING CONTROLS RESPONSIBILITY MATRIX

A. For spaces with standalone lighting controls, the sensors are to be provided by Division 26 to control both HVAC and lighting; The BACS contractor shall provide a single gang box with face plate at the sensor. The following chart outlines the BACS / Division 26 Responsibilities with regard to standalone lighting controls:

STANDALONE LIGHTING CONTROLS	BACS	DIV 26
Emergency Switched 277/120 VAC Power		X
120 VAC Power		X
Emergency Lighting Control Unit		X
Emergency Lighting Transfer Switch		X
Emergency Light Fixture		X
Emergency Lighting Dimming Override		X
Normal Power Light Fixture		X
Controller		X
24 VAC Power		X
Transformer		X

STANDALONE LIGHTING CONTROLS	BACS	DIV 26
Primary Power Pack Relay		X
Secondary Power Pack Relay		X
HVAC OCC/UNOCC COMMAND	X	
Dimming Wall Switches		X
Dimming Control Relay		X
Occupancy Sensors		X
OCCUPANCY	X	
Daylight Sensors		X

B. Certain zone types require that the BACS perform the lighting controls. The following chart outlines the BACS / Division 26 Responsibilities with regard to BACS lighting controls:

BACS LIGHTING CONTROLS	BACS	DIV 26
Emergency Switched 277/120 VAC Power		X
120 VAC Power		X
Emergency Lighting Control Unit		X
Emergency Lighting Transfer Switch		X
Emergency Light Fixture		X
Emergency Lighting Dimming Override		X
Normal Power Light Fixture		X
Controller	X	
24 VAC Power	X	
Transformer	X	
Primary Power Pack Relay	X	
LIGHT ENABLE COMMAND	X	
LIGHT STATUS	X	
Secondary Power Pack Relay	X	
HVAC OCC/UNOCC COMMAND	X	
Dimming Wall Switches		X
Dimming Control Relay	X	
DIMMING COMMAND	X	
DIMMING ENABLE COMMAND	X	
Occupancy Sensors	X	
OCCUPANCY	X	
Daylight Sensors	X	
LIGHT LEVEL	X	

END OF SECTION

PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Schedule of pipe materials, fittings, and connections.

B. Applicable miscellaneous materials (i.e. dielectric protection, hangers, inserts, supports, sealing elements, firestop systems etc.).

C. Anchors and Guides:

1. Provide detailed fabrication drawings for all field-fabricated anchors and guides and intermediate structural elements.

2. Provide submittals for pre-manufactured anchors and guides.

D. Welding certification (Refer to Part 3).

E. Cleaning & Water Treatment (Refer to Part 3)

1. [Initial Water Quality Sample Analysis]

2. Water Quality Sample Analysis after Cleaning

3. Final Water Quality Sample Analysis]

F. Certification of successful pressure testing (Refer to Part 3).

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

B. All adhesives, sealants, primers and paint used for piping in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 STEEL PIPING AND FITTINGS

A. Pipe: ASTM A53, Schedule 40, or extra strong (Schedule 80) weight; black or galvanized finish as called for; ends chamfered for welding.

B. Fittings: Same material and pressure class as adjoining pipe.

1. Welded Fittings: Factory forged, seamless construction, butt weld type, chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets", or "Sockolets" are acceptable. Socket weld type, 2000 psi wp, where required.

a. Mitered elbows, "shaped" nipples, and fabricated reductions and fabricated branch connections are not acceptable unless specifically required and reviewed by the Engineer.

2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for. Street type 45° and 90° elbows are not acceptable.

C. Flanges, Unions and Couplings:

1. Threaded Connections:

a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.

c. Couplings: Malleable iron, 150 or 300 lb. wwp, based on system pressure. Steel thread protectors are not acceptable as couplings.

2. Welded connections:

a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents and working temperatures and pressures.

c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent. Made from welding elbows, with welded pipe support and steel base.

Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
2 in. to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 COPPER TUBE AND FITTINGS - SOLDER JOINT

A. Pipe: ASTM B88; Type L hard temper. Plans show copper tube sizes.

B. Tees, Elbows, Reducers: Wrought copper, ASME B16.22; ASME B16.18 solder end connections.

C. Unions And Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp: 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.

D. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel.

E. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Willard Industries "Solder Safe (silver bearing), Canfield "Watersafe" or approved equal.

2.4 COPPER DRAINAGE TUBE AND FITTINGS - SOLDER JOINT

A. Pipe: ASTM B88; Type M hard temper.

B. Tees, Elbows, Reducers: Wrought copper, ASME B16.22; ASME B16.18 solder end connections.

C. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.

D. Make: Harris "Stay-Safe 50" and "Bright", Engelhard "Silverbright 100", Canfield "Watersafe", or approved equal.

2.5 DIELECTRIC PIPE FITTINGS

A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

B. Dielectric unions shall not be used due to their tendency to leak. Provide a dielectric waterway fitting or a brass nipple for dielectric protection. A brass valve is also an acceptable method of dielectric protection.

C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.

D. Waterway Fittings: 300 psi maximum working pressure at 230°F, male threaded or grooved ends, electroplated ductile iron or steel body with LTHS high temperature polyolefin polymer liner.

E. Make: EPCO, Capitol Manufacturing, Watts or approved equal.

2.6 HANGERS, INSERTS, AND SUPPORTS

A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing, Anvil, Hilti.

B. Hangers:

1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.

2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.

3. Adjustable steel clevis type for 4 in, and larger, and where insulation passes through hanger.

4. Hangers sized to permit passage of insulation through the hanger for all piping.

C. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped Hanger Shields:

1. Pre-Insulated Type:

a. Insulated pipes shall be protected at point of support by a 360° insert of high density, 100 psi waterproof calcium silicate, encased in a 180° sheet metal shield. Insulation insert to be same thickness as adjoining pipe insulation and extend 1 in. beyond sheet metal shield. Insulation shall be provided with a factory installed ASJ.

2. Field-Insulated Type:

a. #18 USSG, galvanized steel shields, minimum 120° arc. Provide ICA-HAMFAB-BLOCK, 18# density molded fiberglass inserts, between pipe and hanger shield to maintain proper spacing for insulation. Insulation inserts shall extend 1 in. beyond the sheet metal shields. Material shall comply with ASTM E84 25/50, have a thermal conductivity of K=.30 (stable) and have a service temperature of -120°F to +650°F. Install in accordance with manufacturer's printed instructions.

3. Shield Sizing:

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2 in. to 3-1/2 in.	9 in.	20
4 in.	9 in.	20
5 in. and 6 in.	9 in.	20
8 in. to 12 in.	12 in.	18
14 in. to 24 in.	18 in.	16

4. Hanger shield gauges listed are for use with band type hangers only. For point loading (roller support), increase shield thickness by one gauge, and length by 50%.

D. Hanger Spacing Schedules: (Based upon most stringent requirement of MCNYS and ASME B31.9)

COPPER OR PLASTIC PIPE SIZE	COPPER PIPE HANGER SPACING	PLASTIC PIPE HANGER SPACING	HANGER ROD SIZE
3/4 to 1 in.	6 ft.	3 ft.	3/8 in.
1-1/4 in.	6 ft.	4 ft.	3/8 in.
1-1/2 to 2 in.	8 ft.	4 ft.	3/8 in.
2-1/2 to 4 in.	10 ft.	4 ft.	1/2 in.
5 in. and larger	10 ft.	4 ft.	3/4 in.

STEEL PIPE SIZE	STEEL PIPE HANGER SPACING	HANGER ROD SIZE
3/4 to 1 in.	8 ft.	3/8 in.
1-1/4 in.	10 ft.	3/8 in.
1-1/2 to 2-1/2 in.	12 ft.	3/8 in.
3 to 4 in.	12 ft.	1/2 in.
5 in. and larger	12 ft.	3/4 in.

E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1,300 lbs., for 3/8 in. to 3/4 in. rod sizes. Drill through decking for hanger rods and secure devices with integral support plate strap with sheet metal screws. Devices shall have a safety factor of four.

F. Beam Attachments:

1. C-Clamp, locknut, electroplated finish, UL listed, FM approved, for pipe sizes 2 in. and smaller.

2. Center load style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

3. Welded beam attachments may be considered only upon the review and acceptance of the structural engineer of record with written confirmation of weld meet configuration, location and service/pipe size submitted to the Mechanical Engineer for review.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Secure member to structure. Select size of members based on a minimum factor of safety of four.

2. For Weights Under 1000 lbs.: Insert, "U" shaped channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.

3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flush plate welded to top of rod or provide additional inserts and hangers to reduce load per hanger below 1000 lbs.

4. Make: Hilti, ITW Ramset, Phillips "Red Head", or approved equal.

H. Trapeze Hangers:

1. For use on 1-1/2" and smaller piping only. Use of trapeze hangers for piping 2" and greater may be considered only upon the review and acceptance of the structural engineer of record with written confirmation of configuration, location and service/pipe size submitted to the Mechanical and Structural Engineer for review.

2. Hangers shall be supported with rod sized with a safety factor of four.

3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.

4. Securely fasten piping to trapeze with "U" bolt or straps, dissimilar metals shall not touch, use isolation gaskets.

5. Make: B-Line, Kindorf, Unistrut, or approved equal.

2.7 PIPING ACCESSORIES

A. Escutcheon Plates: Provide escutcheon plates on uninsulated piping in exposed and finished areas. Steel or cast brass polished chrome, split hinge type with setscrew, high plates where required for extended sleeves.

B. Pipe Guides: Cylindrical steel guide sleeve, proper length for travel, integral bottom base anchor, top half removable. Split steel spider to bolt to pipe, copper plated spider for copper pipe. Insulated style where pipe is required to be insulated. Make: Tri-State Industries, or equal.

C. Anchors:

1. Pipe support; same material as pipe; as manufactured by Pipe Shields Model C1000 or C2000, Keflex, Metraflex, Flexonics or Advanced Thermal Systems.

2. Pipe Anchors:

a. Anchors shall be designed and located as to prevent stress to piping or building structural components from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stressing to connected equipment.

D. Pipe Roll Stand: Cast iron roll stand. Make: Advanced Thermal Systems, Carpenter and Patterson, ITT Grinnell, Pipe Shields.

2.8 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves shall be used for sleeves in horizontal and vertical applications through structural surfaces. Sleeves shall extend a minimum of 1 in. beyond both sides of the structure surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping installation or requirements of the sealing element manufacturer.

2. Full circle water stop collar for sleeves located in below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.

3. Schedule 40, PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing. Sleeves shall extend a minimum of 1/2 in. beyond both sides of the non-structural vertical surface being penetrated. The sleeve shall be sized to account for the total diameter of the service, inclusive of insulation and the appropriate annular space for firestopping.

B. Pre-Insulated Type:

1. Adjustable or fixed length metal cans, 24 gauge minimum sized for 1 in. spacing between insulation and can. Insulation shall consist of a 360° waterproofed calcium silicate insert sized to extend 1 in. beyond wall or floor penetration. Calcium silicate insert shall be the same thickness as adjoining pipe insulation. Spacing between shield and can packed at each end with double neoprene rope positively fastened.

2.9 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Penetration Firestop Systems". The system shall meet the standard fire test for Penetration Firestop Systems designated ASTM E814.
Firestop system shall be provided at locations where piping passes through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.10 PIPING MATERIALS AND SCHEDULE

A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (HVAC) piping.

2.11 CLEANING AND TREATMENT CHEMICALS

A. Cornell University shall furnish cleaning and water treatment chemicals to the contractor. Cleaning and treatment chemicals are furnished from The Metro Group. The information on the various materials listed below is for reference only.

1. Probable cleaning chemicals: Metro Cleaner CS35 or CS46. General detergent-based, heavy duty, alkaline cleaners, multifunctional. Selection based on an understanding the deposit being removed and system materials (steel, copper, aluminum, etc.).

2. Treatment chemicals for Closed Loop Non-Glycol Heating and Cooling Systems: Vaporene 6400. A material with a combination of sodium molybdate, sodium tolutriazole, sodium polyacrylate and borax amber in color.

3. Treatment chemicals for Closed Loop Glycol Heating and Cooling Systems: Metro PG36. A material with a combination of 40% propylene glycol, nitrite, and tolytriazole with an olive-green colorant. Contact Facilities Engineering for applications that have the potential to deviate from this requirement, for example ground loop geo-exchange systems.

B. The approximate system volumes are as follows:

1. Glycol Preheat: 170 Gallons.

2. Campus High Temp Hot Water: 40 Gallons.

3. Reheat/Perimeter Hot Water: 140 Gallons.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

A. Provide equipment and systems in accordance with laws, codes, and provisions of each applicable section of these specifications. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing (except where specifically called for), making proper allowance for expansion and anchoring. Arrange piping at equipment with necessary offsets, union, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Install drains consisting of a tee fitting with a 3/4 in. ball valve with hose end cap and chain, at low points in hydronic piping system mains, and elsewhere as required for system drainage.

B. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation.

Make changes in direction and branch connections with fittings unless submitted and accepted per Part 2. Do not install valves, union and flanges in inaccessible locations. Provide trap seal of adequate depth on drain pans.

C. Provide reducers at all control valves, where control valve is smaller than pipeline size. Reducers for steam control valves shall be eccentric type. Provide unions at each side of every control valve and reducers directly adjacent to the unions.

D. Provide reducers at all balance valves, where balance valve is smaller than pipeline size.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3 ft. to 9 ft. depending on the voltage.

3.3 WATER AND GLYCOL SYSTEMS

A. Top connection for upfeed, bottom or side connection for downfeed. Grade off level; up in direction of flow and down toward drain.

3.4 CONDENSATE DRAIN PIPING

A. Condensate drain piping shall be sloped a minimum of 1% in the direction of flow to an approved place of disposal. Condensate shall not be disposed into a street, alley or other areas so as to cause a nuisance.

B. Condensate drain piping shall not be less than 3/4" internal diameter and shall not decrease in size from the drain pan connection to the location of condensate disposal.

C. Condensate drains shall be trapped as required by the equipment or appliance manufacturer.

D. Condensate drain piping shall be configured to permit the clearance of blockages and performance of maintenance without requiring the drain piping to be cut.

3.5 HANGERS, INSERTS AND SUPPORTS

A. Piping shall not be supported by wires, band iron, chains, or from other piping. Support each pipe with individual hangers from concrete inserts, welded supports, or beam clamps of proper configuration and point loading design requirements for each location including the designated safety factor. Trapeze hangers are acceptable for racking of multiple pipes of 1-1/2 in. or less in size. Follow manufacturer's safe loading recommendations.

Suspend with rods of sufficient length for swing and of size as called for, using four nuts per rod. Provide additional rustproofed structural steel members, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Only concentric type hangers are permissible on piping larger than 2-1/2 in., "C" types are permitted for piping 2-1/2 in. and smaller. Provide riser clamps for each riser at each floor.

B. Provide a pipe hanger within 12 in. of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.6 HANGERS ATTACHED TO JOISTS

A. Individual hangers may be suspended directly from the bottom chord panel point provided that the sum of the concentrated loads within the chord panel does not exceed 100 pounds and the attachments are concentric to the chord. (Eccentrically loaded joists using beam clamps or other attachment methods are not acceptable.)

B. For nominal concentrated loads between panel chords, which have been accounted for in the specified uniform design load for the joists, this Contractor is to provide struts to transfer the load to a panel point on the opposite chord as reviewed and acceptable by the Structural Engineer of Record.

3.7 PIPE CONNECTIONS

A. Solder Connections: Nonacid flux and clean off excess flux and solder.

B. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specific for each application.

C. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

D. Dielectric Pipe Fittings: Provide dielectric protection devices at ALL piping connections and ALL equipment connections, where dissimilar metals meet. Follow all applicable manufacturer's recommendations at equipment connections. Dielectric protection systems are not required for air or gas systems.

3.8 WELDING

A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. When welding galvanized pipe, apply cold galvanizing on joint after welding.

3.9 HANGER SHIELDS

A. Provide at hangers for all piping. Pre-insulated type or field-insulated type at Contractor's option.

3.10 SLEEVES

A. Provide for pipes passing through floors, walls or ceilings. Not required for floors which are core-drilled, except where floor is waterproofed.

B. Pre-Insulated Type: Required for chilled water.

C. Standard type: Provide for piping, except as called for.

D. Extend 1/8 in. above finished areas. In above grade mechanical and other areas with floor drains; use steel pipe sleeves 2 in. above floor. Use pipe sleeves in bearing walls, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.11 ANCHORS

A. Provide piping system anchors where shown on the plans, and as recommended by the expansion joint/loop manufacturer. Where an anchor is shown at a change in piping direction, it shall fully control movement in both directions. In lieu of a single anchor fabricated for two directional control, two (2) individual anchors may be provided. Provide detailed fabrication drawings for all field-fabricated anchors.

B. Design anchors and equipment and piping supports including comprehensive structural engineering analysis by a qualified professional engineer, licensed to practice in the State of New York using the performance and design criteria specific to this project.

3.12 ALIGNMENT GUIDES

A. Provide alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two (2) or more guide(s) on each side of flexible expansion loop. Install guides nearest to expansion joint not more than four (4) pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

3.13 SLEEVE PACKING

A. Seal void space at sleeves as follows

1. Interior locations: Firmly pack with fiberglass and caulk.

2. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.

3. Waterproofed walls and floors: Use waterproof sealing element, device, or compound.

3.14 ESCUTCHEON PLATES

A. Provide polished chrome escutcheon plates for uninsulated exposed piping passing through floors, walls or ceilings in finished areas.

3.15 CLEANING HOT WATER AND CHILLED WATER AND GLYCOL SYSTEMS

A. Cornell University's continual approach of protecting its community and the environment must be adhered to in the application of chemicals. Under no circumstances should chemicals be disposed of by pouring into sinks or other drains leading to sanitary or storm sewers.

B. Water quality testing shall be performed prior to system cleaning and testing. The quality of water delivered to each facility on the Cornell campus has significant variation based on the distribution system piping materials and source; therefore, incoming water conditions cannot be accurately predicted. Coordinate with the Cornell Facilities Management Water Treatment Lab (FMWTL) for water samples. Samples will need to be sent to an independent laboratory for analysis; information will be needed when testing residual concentrations during cleaning and treatment. As a minimum, water samples shall be analyzed for the following parameters:

WATER PARAMETER	UNITS
pH	-
Total Dissolved Solids	(mg/L)
Conductivity	(µS/cm)
Chlorides	(mg/L)
Iron	(mg/L)
Copper	(mg/L)
Calcium	(mg/L)
Magnesium	(mg/L)
Alkalinity as CaCo3	(mg/L)
Calcium Hardness as CaCo3	(mg/L)
Total Hardness as CaCo3	(mg/L)

C. All closed loop recirculating water systems for new and existing piping systems require cleaning or passivation prior to the introduction of chemical treatment.

1. Cleaning of existing systems removes dislodged corrosion products.

2. Cleaning of new systems removes oils, mill scales and other residual materials of construction introduced during construction.

D. Cleaning procedures shall be as follows:

1. Step 1: Adjust all control valves and balancing valves to full-open position.

2. Step 2: Drain/flush system volume for removal of preliminary suspended matter. Bleed-off rate should not exceed rate of make-up. Confirm quality using conductivity test (system ≈ make-up water ± 25%)

3. Step 3: Add cleaning agent through the bypass feeder at a concentration recommended by the chemical manufacturer. Validate presence of dispersed species by inspection of filter papers and by monitoring water quality (pH, iron and conductivity values). Circulate solution for 4-8 hours or as specified the manufacturer.

4. Step 4: Drain/flush system until system water until water is visibly clear. Bleed-off rate should not exceed rate of make-up. Verify completion of flushing process with a conductivity test (system ≈ make-up water ± 10%)

5. Step 5: Clean strainers and dead-end piping legs.

6. Step 6: Arrange for inspection by a representative from the Facilities Management Water Treatment Lab before proceeding with chemical treatment. Test results shall be forwarded to the Facilities Management Water Treatment Lab and Project Manager.

3.16 TREATMENT OF HOT WATER AND CHILLED WATER AND GLYCOL SYSTEMS

A. Cornell University's continual approach of protecting its community and the environment must be adhered to in the application of chemicals pertinent to process water loops. In addition, University policy dictates that "under no circumstances should chemicals be disposed of by pouring into sinks or other drains leading to sanitary or storm sewers".

B. Pumps shall not be operated continuously until system is flushed, strainers cleaned and water treatment is complete. Immediately after cleaning and inspection, drain the system and fill the system as follows:

1. Chilled Water Systems directly connected to the campus distribution system:

a. Chemical treatment shall not be used.

b. Fill the system with potable water.

c. Notify the Central Energy Plant (CEP) for permission to begin circulating water into the campus chilled water loop.

2. Treatment for Closed Loop Non-Glycol Heating and Cooling Systems: Dose with Vaporene 6400 using manufacturer's recommendations. Circulate for 24 hours then coordinate with Metro to test water to validate product concentration.

Add more inhibiters if required.

3. Treatment for Closed Loop Glycol Heating and Cooling Systems: Fill with pre-mixed Metro PG36, 40% propylene glycol solution. Test for residual concentrations as follows:

a.	Propylene glycol:	400,000 ppm (40%)
b.	Nitrite:	1500 ppm
c.	Tolytriazole:	20 ppm
d.	Water:	Balance

C. Arrange for inspection by a representative from the Facilities Management Water Treatment Lab prior to final acceptance. Test results shall be forwarded to the Facilities Management Water Treatment Lab and Project Manager.

D. Provide a three-ring binder in the mechanical room containing the following information for each hydronic system treated with chemicals:

1. SDS, product data sheets, chemical type, test points, control limits and system volume.

2. Direction to drain system to sanitary drain.

3.17 TESTS

A. Test piping and accessories before insulation, connection to existing piping, or concealment. Repeat as many times as necessary to prove tight system. Notify Owner's Representative at least seven days in advance of each test. Isolate valves and equipment not capable of withstanding test pressures. Make leaks tight; no caulking permitted. Remove and replace defective fittings, pipe or connections. Furnish necessary pumps, gauges, equipment, piping, valving, power and labor for testing. Certify that tests have been successfully completed.

B. Test: No change in pressure under stable temperature conditions.

C. Schedule of Test Requirements:

1. Hot, Glycol, Chilled: Hydrostatic, 100 psig at high point of system; two hours duration.

2. Equipment: Test at working pressures.

3.18 PROTECTION AGAINST PHYSICAL DAMAGE

A. In concealed locations where piping, other than cast-iron or steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 in. from the nearest edge of the member, the pipe shall be protected by shield plates.

Protective steel shield plates having a minimum thickness of 0.0575 in. (No. 16 gage) shall cover the area of the pipe where the member is notched or bored and shall extend note less than 2 in. above sole plates and below top plates.

3.19 PIPE LINE SIZING

A. Pipe sizes called for are to be maintained. Pipe sizing changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (HVAC)

SERVICE	PIPE MATERIALS	FITTINGS	CONNECTIONS
Hot water / Glycol hot water heating 3 in. and larger	ASTM A53 Schedule 40, black steel	ASME B16.9 Wrought steel	ASME B16.9 Butt weld
Hot water / Glycol hot water heating 2-1/2 in. and smaller	ASTM B88 Type L hard copper	ASME B16.22 Wrought copper	ASTM B32 95 Sn/5 Sb solder or 95.5 Sn/4 cu/.5 Ag solder
Chilled water 3 in. and larger	ASTM A53 Schedule 40, black steel	ASME B16.9 Wrought steel	ASME B16.9 Butt weld
Chilled water 2-1/2 in. and smaller	ASTM B88 Type L hard copper	ASME B16.22 Wrought copper	ASTM B32 95 Sn/5 Sb solder or 95.5 Sn/4 cu/.5 Ag solder
Vent, overflow, condensate drain	ASTM B88 Type M hard copper	ASME B16.22 Wrought copper	ASTM B32 95 Sn/5 Sb solder or 95.5 Sn/4 cu/.5 Ag solder

END OF SECTION

WATER SYSTEMS SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Submit product data on water system specialties.

1.3 GENERAL REQUIREMENTS

A. Equipment and accessories shall be rated for a minimum of 125 psi wwp, and 250°F temperatures.

B. All equipment shall be installed in accordance with manufacturer's written installation instructions and schematics.

C. Combination devices and pre-piped manufacturer coil fit out kits are not permitted, including but not limited to the following:

1. Manual balance, control, ball isolation valves

2. Manual balance, strainer, ball isolation valves (TDV)

3. Y-strainer, ball isolation valves

4. Ball isolation, drain valves

5. Balancing, shutoff valves

PART 2 - PRODUCTS

2.1 HOT WATER/GLYCOL SYSTEM IN LINE AIR SEPARATOR

A. All fittings shall be fabricated steel, rated for 150 psig design pressure and be selected for less than 1 foot of water pressure drop and velocity not to exceed 4 feet per second through the unit at specified GPM. Performance curves from the unit manufacturer shall be furnished as part of the submittal for each unit. Units to include internal copper coalescing medium to facilitate maximum air elimination and suppress turbulence. Provide integral high capacity float actuated air vent at top fitting of tank. Alternates must include cast iron float actuated air vent rated at 150 psig which shall be threaded to the top of the fitting. Unit shall have bottom blow down connection with ball valve.

B. Air separators shall be capable of removing 100% of free air, 100% of entrained air and up to 99.6% of dissolved air in the system fluid. System efficiency and performance shall be third party tested and certified.

C. Design Equipment: Spirovent.

2.2 CHILLED WATER SYSTEM IN LINE AIR SEPARATOR

A. All fittings shall be fabricated steel, rated for 150 psig design pressure and be selected for less than 1 foot of water pressure drop and velocity not to exceed 4 feet per second through the unit at specified GPM. Performance curves from the unit manufacturer shall be furnished as part of the submittal for each unit. Units to include internal copper coalescing medium to facilitate maximum air elimination and suppress turbulence. Provide integral high capacity float actuated air vent at top fitting of tank.

B. Air separators shall be capable of removing 100% of free air, 100% of entrained air and up to 99.6% of dissolved air in the system fluid. System efficiency and performance shall be third party tested and certified.

C. Separates dirt particles down to 5 micron and ferrous material using magnets within the flow path.

D. Design Equipment: Spirovent VDT-M

2.3 PRESSURIZED EXPANSION TANKS AND ACCESSORIES

A. Steel tanks, 125 psi wwp, ASME construction, with reinforced opening of size and location as required. Red oxide coating outside and final exterior coat of paint; factory applied. Heavy duty butyl rubber removable bladder. Full acceptance vessel. Maximum operating temperature of 240°F. Provide ring stand.

B. Design Equipment: The John Wood Company

C. Manufacturers: Armstrong, Bell & Gossett, The John Wood Company

2.4 AIR ELIMINATING SUPPLY FITTING

A. Designed to eliminate air from supply water; located in supply header from heat generating devices; flanged or screwed.

B. Design Equipment: Bell & Gossett "Airtrol".

C. Manufacturers: Armstrong, Bell & Gossett, Spirotherm.

2.5 RELIEF VALVES

A. To relieve full heating capacity.

B. Provide an ASME labeled safety relief valve as called for on the plans/details.

C. Manufacturer: ITT, Bell & Gossett, Watts, Kunkle, Spence, Keckley.

2.6 FLOW BALANCERS

A. High Performance, Bronze Body, Y-Pattern with brass readout valves with integral self-sealing EPT readout valves.

B. Valve shall be multi-turn globe style with calibrated digital hand wheel capable of at least four turns with graduations at 1/10th turn. Hand wheel shall be equipped with a positive, tamper-resistant memory stop that effectively prevents opening valve past the stop.

C. Valve shall not be integral to flow balancer. Combination services are not acceptable.

D. Valve shall be provided with an integral, positive, tamper-resistant memory stop feature which is not subject to accidental readjustment when the valves is operated as a shut-off for service purposes. Memory stop shall require a tool for adjustment.

E. Valve shall have provisions for a seal to prevent re-setting.

F. Valve shall exhibit an accuracy of +/- 5% within its normal operation flow range.

G. Valves shall be rated for a maximum temperature of 230°F and a maximum pressure of 250 psig.

H. Valves shall be manufactured from Bronze or Dezincifcation resistant brass in sizes through 2" nominal, and bronze or cast iron in sizes above 2" nominal.

I. For chilled water applications, valve shall be provided with preformed insulation to permit access for balance and readout.

J. Mechanical Contractor shall supply Testing and Balancing Contractor with flow calculator (circular slide rule, etc.), if requested.

K. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60
2-1/2 in.	60 - 100
3 in.	100 - 180
4 in.	180 - 300
5 in.	300 - 450
6 in.	450 - 600

1. Design Equipment: Tour & Anderson.

2. Manufacturers: MMA, Macon, Tour & Anderson.

L. 5 in. and Larger: Nickel-plated flow meter with provisions for connecting a portable differential pressure meter. Shall be individually calibrated. Provide with a butterfly valve with memory stop at each location.

1. Flow meter size shall be based upon manufacturer's recommended gpm range rather than pipe size.

2. Design Equipment: Tour & Anderson.

3. Manufacturers: MMA, Macon, Tour & Anderson.

2.7 SUCTION DIFFUSER

A. Provide as shown on plans, an angle pattern flow straightening fitting equipped with a combination diffuser-strainer-orifice cylinder, flow straightening vanes, start-up strainer and adjustable support foot. The combination diffuser-strainer-orifice cylinder shall be designed to withstand pressure differential equal to the system pump shutoff head (maximum 175 PSIG) and shall have a free area equal to five times the cross section area of the pump suction opening. The length of the flow straightening vanes shall be no less than 2-1/2 times the diameter of the system pump suction connection.

B. The Flow Straightening Fitting shall have NPT, flanged or (grooved) mechanical system connections as applicable. The fitting shall have a stainless steel combination diffuser-strainer-orifice cylinder with 3/16 in. diameter perforations to protect the system pump, and full length flow straightening vanes shall provide nonturbulent flow to the suction side of the system pump. The start-up strainer shall be of 16 mesh bronze, and the support foot shall eliminate pipe strain at the flow fitting/pump connection. All internal components shall be replaceable.

C. Construction Materials:

1.	Body and Cover:	NPT and Flanged Models Grooved Models	Cast Iron Ductile Iron
2.	Straightening Vanes:	X Models Z and Grooved Models	Steel Stainless Steel
3.	Orifice Cylinder:	Z and Grooved Models	Stainless Steel
4.	Start-Up Strainer:	X, Z and Grooved Models	16 Mesh Bronze
5.	O-Ring Seal:	All models	EPDM

6. Type X Models (for closed systems).

7. Type Z for (open systems).

D. Design Equipment: Bell & Gossett.

E. Acceptable Manufacturer: Bell & Gossett, Armstrong, Grundfos.

2.8 DUPLEX STRAINER (CHILLED WATER)

A. Construction Materials:

1. 125 psig working pressure.

2. Bronze diverter valve.

3. Flanged end connections.

4. Cast iron body and bolted cover.

5. Perforated stainless steel basket screen.

6. Viton seals.

B. Accessories:

1. Differential pressure indicators.

2. DIN Electrical probes.

3. 100% shut-off.

4. Air eliminators.

C. Acceptable Manufacturers:

1. Keckley Model DPXF or equal.

2.9 STRAINERS

A. Cast semi-steel body or cast iron construction for steel piping and bronze body construction for copper piping; equipped with removable, monel or stainless steel water screen; maximum pressure drop 2 psi with free area at least four times area of pipe. Provided with blow-off outlet.

B. Sizes 5 in. and Smaller, Y-Pattern Strainer: 125 psig working pressure; flanged ends for NPS 2-1/2 in. and larger, threaded connections for NPS 2 in. and smaller, bolted cover, perforated stainless steel basket and bottom drain connection.

C. Design Equipment: Mueller.

D. Manufacturers: Elliott, Keckley, Mueller, Webster, Watts, Spirax-Sarco.

2.10 AIR VENTS

A. Manual air vents shall be a 3/4 in. ball valve with hose end. It shall meet the requirements of Section 25 05 04 – Valves.

B. Automatic air vents shall be float type, 35 psig rated, Armstrong No. 502CV OR float type, 150 psig rated, Armstrong No. 75 or Spirotop. Provide unit with an appropriate rating, as necessary for location.

C. High Capacity Automatic Air Vent:

1. Cast iron body. 150 psig rated. Stainless steel float.

2.11 FLEXIBLE PIPE AND PUMP CONNECTIONS (BRAIDED STAINLESS STEEL)

A. Braided stainless steel pump and pipe connector(s) shall be constructed of annular corrugated stainless steel close-pitch hose with stainless steel over braid. The corrugated metal hose, braid(s) and a stainless steel ring-ferrule/band (material gauge not less than .048 in.) shall be integrally seal-welded using a 100% circumferential, full-penetration TIG weld. Fittings shall be attached using a 100% circumferential TIG weld.

B. Braided stainless steel pump and pipe connector(s) must be suitable for operating temperatures up to 850°F. The rated working pressure of the braided metal hose must have a minimum 4:1 safety factor.

C. Each braided stainless steel connector shall be individually leak tested by the manufacturer using air-under-water or hydrostatic pressure.

D. Braided stainless steel connectors shall carry a three (3) year warranty when installed in accordance with all specifications and installation instructions as described by the manufacturer.

E. End fittings shall be flat-faceplate steel flanges with 150# ANSI drilling, and outside diameter, carbon steel MPT ends, flanged by Schedule 40 grooved ends or increasing ends.

F. Acceptable Manufacturers: Flexhose Pumpsaver or equivalent Keflex, Metraflex, Mason-Mercer.

2.12 GLYCOL STORAGE TANK

A. One (1) fifty-gallon polyethylene solution tank, with cover, mounted in a welding steel frame. Frame shall be furnished with an epoxy coating to resist chemical attack.

B. Manufacturers: Wessels

2.13 CHEMICAL FILTER FEEDER

A. 2-gallon carbon steel body, domed bottom, powder coated finish, rated for 320 psi at 250°F.

B. Funnel kit with sealed safety bar closure cap rated for design pressure. Furnish with pedestal mounted legs. Provide site glass with damage guard and associated isolation valves. Provide air vent with manual air release valve. Provide 20 micron bag filter.

C. Design make: Griswold.

D. Makes: Griswold, Neptune, Wessels.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Obtain detailed instructions from each manufacturer for proper method of installation.

3.2 SYSTEM FILLING

A. After cleaning, fill each system from low point.

B. With pumps off, vent mains, risers, run-outs, and units, working consecutively from low to high point of building. Obtain approximately 2 psi at highest point. Obtain proper air cushion in compression/expansion tanks.

3.3 AIR VENTING

A. Provide where specifically called for in piping details and at all points in piping systems where air may collect due to changes in piping elevation.

1. Manual air vent assembly consisting of 1-1/4 in. x 4 in. air collection chamber with 3/4 in. hose end ball valve with cap and chain.

2. Automatic air vent with a ball valve for the purpose of isolation and service or replacement. Do not use automatic vents on glycol systems or chilled water systems connected to the district; use manual vents only.

3. Unless otherwise indicated, automatic air vents shall only be installed in Mechanical Rooms. Pipe high capacity air vent discharge down to floor.

B. Equipment Vents:

1. When equipment is above mains: Connect run-outs or risers to upper quadrant or top of mains. Install vent assembly concealed within enclosure, consisting of 1 in. diameter by 4 in. to 6 in. long air collection chamber with 1/4 in. soft copper tube to manual valve. Mount securely near bottom of enclosure, but not fastened to enclosure. For individual units, radiators, fan convectors and units with return grilled: Provide screwdriver operated manual valve, operated from discharge grille or access door. Drill enclosure and position valve for operating without removing enclosure.

2. When equipment is below mains: Connect piping run-outs or risers to bottom or lower quadrant of mains. Vent assembly not required in unit. Provide means of purging and draining each unit if required. Use tees instead of ells at low point of run-outs.

3.4 AIR SEPARATOR

A. Provide supports and provide blow-down with hose end drain valve. Hang unit from structure at an elevation low enough to allow for upward pitch of piping to compression tank.

3.5 EXPANSION TANKS

A. System volume shall be stenciled on the system expansion tank in a visible location.

B. Label the piping at the fill point with the fill material and % glycol.

3.6 RELIEF VALVES

A. Hot Water System: Pipe discharge to floor drain and place hanger at elbow. Install piping so as not to introduce stress of PRV body.

B. Glycol System: Pipe discharge to glycol solution storage tank. Install piping so as not to introduce stress of PRV body.

3.7 FLOW BALANCERS

A. Where flow balancers are smaller than pipe line size, provide reducers directly adjacent to flow balancers.

B. Provide on each hydronic unit and where called for. Meter connection points shall not point downward.

3.8 SUCTION DIFFUSERS

A. Provide at inlet to base mounted pump.

B. Pipe suction diffuser blow-off connection (full size with ball valve) to nearest floor drain.

3.9 STRAINERS

A. Install strainers on supply side of each control valve, pressure reducing valve, solenoid valve, in-line pump and elsewhere as indicated. Install NPS 3/4 in. nipple and ball valve in blowdown connection of strainers NPS 2 in. and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 in.

3.10 GLYCOL STORAGE TANK

A. Set unit on a 6 in. concrete pad.

B. Pipe all relief valves to solution tank.

END OF SECTION

PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required, for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Shop drawings and performance curves, on pumps and pump accessories clearly indicate which equipment is being submitted.

B. Provide catalog information on motors as specified in section 230513.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Pumps shall be non-overloading over their entire performance range with motors capable of running continuously without undue noise, heating, or sparking. Impellers shall be statically and dynamically balanced. Provide mechanical seals for closed systems, constructed of carbon rings with ceramic mating seat up to 220°F. Provide packing type seals for open systems only. Provide materials suitable for water pressures, temperature and conditions for each application. Provide tapped discharges and suction connections for gauges, vent and drain. Provide factory trimmed impeller if required, to meet initial delivery requirements.

B. Provide the services of a factory service engineer or machinist to check each pump alignment before pump is started, using laser equipment.

2.2 SELECTION CRITERIA

A. Pumps shall be non-overloading over their entire performance ranges, with trimmed impeller as required to meet initial delivery requirements. Pump selection shall not take into account or infringe on the service factor of the motor.

B. Select pumps at appoint within the maximum efficiency for a given impeller casing combustion. Deviations within 3 percent of maximum efficiency are permissible, provided that the lesser efficiency is not less than the scheduled efficiency.

C. Pumps may not be selected such that the impeller diameter is larger than 90 percent of the published maximum diameter for the casing using smaller equipment than the scheduled equipment.

2.3 END SUCTION TYPE (BASE MOUNTED)

A. Designed for continuous operation between 40° and 225°. Single stage, end suction, bronze fitted, with cast iron volute for service to 175 psi wp. Enclosed bronze impeller mounted on a hardened, alloy steel shaft with regreasible ball bearings. Pump shall be direct connected to the drive motor by means of a rubber insert, flexible coupling with ANSI/OSHA guard. Pump and motor shall be mounted on a groutable structural steel main-frame with welded cross members. Pumps used in a variable speed pumping system shall contain couplings suitable for very low and intermittent torque loads.

B. Design Equipment: Bell & Gossett Series e-1510.

C. Acceptable Make: Armstrong, Bell & Gossett, Taco, Grundfos.

2.4 IN-LINE BOOSTER PUMPS

A. Designed for continuous operation between 40° and 225°F. Single stage, end suction with cast iron case constructed for 175 psi wp. Enclosed, bronze impeller mounted on a hardened, alloy steel shaft, mounted with bronze sleeve bearings. Pump shall be direct connected to the drive motor by means of a flexible coupling.

B. Design Equipment: Bell & Gossett Series e-90.

C. Make: Armstrong, Bell & Gossett, Taco, Grundfos.

2.5 WET ROTOR CIRCULATOR PUMPS

1. The wet rotor circulator pump shall be certified and listed by UL (1Z28 Water circulating pump) and/or CSA (Water Circulating Pump) and/or ETL Water Circulating Pump) for conformance to U.S. and Canadian Standards to operate at maximum 230 deg F and minimum 35 deg F water.

    a. The pumps shall be of the quiet wet rotor in-line design with the sound pressure level of the pump lower than 38dB(A)

    b. The pumps shall be capable of operating continuously at 200 deg F.

    c. The pump housing shall be of the in-line type, constructed of cast iron and have a stainless steel neck ring to minimize recirculation and increase pump efficiency.

    d. The impellers shall be of the radial type with curved blades and constructed of composite PES 30% GF. The impeller shall be secured to the shaft by a split cone and nut.

    e. The suction and discharge flanges shall be tapped and drilled to allow gauge installation on the pump.

    f. The pump rotor can, rotor cladding, shaft, and bearing plate shall be constructed of stainless steel.

g. The terminal box shall be made of black composite material. Enclosure class shall be IP44. Aluminum terminal boxes shall not be acceptable. The terminal box shall be able to connect directly to the mains without the need of an external contactor and shall be suitable to accept add-on modules.

h. CIM module with BACnet field bus standard for connection to BMS.

i. Design Equipment: Bell & Gossett Ecocirc.

j. Acceptable Make: Armstrong, Bell & Gossett, Grundfos.

2. OPERATING MODES

a. The pump shall have the following control modes:

b. During operation, the pump shall be capable of automatically reducing the factory-set setpoint and adjusting it to the actual system characteristic. Manual setting of the setpoint shall not be possible.

c. Pump shall be capable of: Proportional Pressure – The head delivered shall be reduced from a manual setpoint linearly in accordance with decrease in flow demand in the system

d. Pump shall be capable of: Constant Pressure – A manual set constant head shall be maintained, irrespective of flow.

e. Pump shall be capable of: Constant Curve – The pump shall run as an uncontrolled pump according to a pump curve set. The pump shall have between 5 and 10 curves in addition to maximum and minimum capable of being selected from the control panel. Additionally, the pump shall have between 41 and 91 curves in addition to maximum and minimum capable of being selected from a wireless remote control.

f. Pump shall be capable of: Automatic Night-Time duty – The pump shall change automatically between normal duty and night-time duty. Changeover between normal and night-time duty shall take place as a result of flow-pipe temperature measured by an internal integrated temperature sensor. The changeover shall take place when the temperature sensor registers a flow-pipe drop of more than 50-60 Degrees F within approximately 2 hours. The required temperature drop shall be a minimum of 32 degrees F per minute.

g. Temperature Influence – The pump shall be capable of temperature influence set to a maximum temperature of either 120 degrees F or 180 degrees F. A drop in flow-pipe temperature will cause a linear reduction of setpoint.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

C. Provide 6 in. concrete pad for each base mounted pump. Level base so that pump and pump casing are not strained. Align pumps as directed by manufacturer. After pumps have been aligned, install dowels to prevent shifting. Fill base with non-shrink grout through grouting holes provided in baseplate. Contractor responsible for accurate size of base and exact location of mounting bolts. Contractor responsible for trouble resulting from poor pump alignment.

D. Base mounted end suction pumps shall be provided with inlet suction diffusers where shown on drawings. Pipe suction diffuser blow-off (full line size with ball valve) to nearest floor drain. Provide start-up strainers for first 48 hours of operation. Replace after completion of start-up period.

E. In-line pumps shall be installed using continuous-thread, hanger rods and elastomeric hangers of size required to support weight of in-line pumps.

F. Provide inertia bases as specified. Refer to Specification Section 230548 for additional details.

3.2 ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment services for all pumps that use a coupler attached to the device train, whether base mounted or inline mounted. Alignment shall be accomplished with a laser shaft alignment system.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

E. Provide an alignment report indicating alignment setup data, tolerances and final results.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Check piping connections for tightness.

3. Clean strainers on suction piping.

4. Perform the following startup checks for each pump before starting:

a. Verify bearing lubrication.

b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.

6. Start motor.

7. Open discharge valve slowly.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION

SHEET METAL AND DUCTWORK ACCESSORIES CONSTRUCTION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 QUALITY ASSURANCE

A. Ductwork shall be fabricated and installed in compliance with latest edition of the following standards and with the edition of the Codes in effect at the time the building permit is obtained.

1. SMACNA Duct Construction Standards - Metal and Flexible Ductwork.

2. SMACNA Duct Liner Application Standard.

3. SMACNA HVAC Air Duct Leakage Test Manual.

4. Mechanical Code of New York State.

5. Energy Conservation Construction Code of New York State.

6. Plans and Specifications which exceed the requirements in any of the referenced standards.

B. All sheet metal shall be fabricated and installed by an experienced Contractor specializing in this type of work.

C. All ductwork and fittings shall have a computer-generated label affixed to the exterior surface of each section, detailing all applicable information including the duct dimensions, gauge, reinforcement type/class and connection type by systems manufacturer. Galvanizing thickness shall be clearly stenciled on each duct section.

D. All ductwork on the project shall meet the SMACNA Duct Cleanliness for New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

1.3 SUBMITTALS

A. Submit a complete shop standard manual including miscellaneous materials, and construction details for all shop fabricated materials including, but not limited to, volume dampers, turning vanes, duct sealant, equipment flexible connections, access doors, flexible duct, etc.

B. Ductwork Shop Drawings

1. Prepare minimum 1/4 in. scale drawings:

a. Detailed ductwork shop drawings shall include size, layouts and pressure classifications. Any ductwork installed without benefit of review by the Engineer of Record may be subject to replacement at the expense of the Contractor.

b. Constructed from actual field inspections and measurements so as to assure a complete job.

c. Incorporate dimensions of actual equipment proposed for use on the project.

d. Showing adequate sections, elevations, and plan views and indicating the bottom of ductwork elevations from the finished floor.

e. Indicating all volume dampers, fire dampers, smoke dampers, damper access doors and other accessories required for a completed project.

f. Indicate roof, wall and floor opening dimensions and locations shown on shop drawings.

g. Indicate the location of the duct smoke detectors, increase duct size, ensure the minimum straight ductwork upstream or/and downstream at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size required with 28 "Electronic Safety and Security".

2. Call to the attention of the Engineer immediately, any major deviations from the Contract Drawings, which must be made. All deviations shall be documented in writing. Resubmit with corrections for final Engineer review.

3. Submit prints to each Sub-Contractor of the other trades for review for interferences and coordination with their work.

C. Prepare a duct pressure testing report similar to that suggested by SMACNA and submit for review. Duct testing shall be conducted in the presence of the Owner's Representative. Provide test reports indicating pressure tests performed. Include date, a ductwork approved shop drawings sheet with the section tested highlighted, test pressure and leakage rate.

1.4 GENERAL

A. All adhesives, sealants, primers and paint used for ductwork in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

1.5 DUCTWORK CLASSIFICATION

A. Duct systems are to be classified and constructed per the SMACNA Velocity-Pressure classification system as follows:

1. All ductwork shall be constructed for a minimum pressure class of 2 in. w.g., unless stated otherwise, for the following systems, as applicable:

a. Supply duct downstream of terminal units.

b. Typical low pressure supply ductwork.

c. Typical return ductwork.

d. Typical low pressure exhaust ductwork.

2. Supply duct upstream of terminal units shall be constructed for a minimum pressure class of 3 in. w.g., unless otherwise stated, or required as per below.

3. Pressure classes above 3 in. w.g. shall be provided as follows, based upon the external static pressure as scheduled for each specific fan.

Scheduled External Static Pressure	**Pressure Class**
Over 3 in. up to 4 in. w.g.	4 in. w.g.
Over 4 in. up to 6 in. w.g.	6 in. w.g.
Over 6 in. up to 10 in. w.g.	10 in. w.g.

B. Any new ductwork connected to existing systems must adhere to the requirements outlined above. Contractors are responsible for verifying the maximum static pressure of the existing systems to determine the appropriate pressure class for the new ductwork. Inform Owner’s Representative and Engineer of any unknown conditions or discrepancies.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. See Exhibit at the end of this section for where sheet metal materials shall be applied, and remarks.

1. Galvanized Sheet Steel: Comply with ASTM A653 and A924, with G90/Z275 coating.

2. Stainless Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in Exhibit "I"; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D or No. 3 as indicated in Exhibit "I".

3. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

4. Gauges per SMACNA HVAC Duct Construction Standards, Metal and Flexible.

B. Make: Semco, United Sheet Metal, unless noted otherwise, or approved equal.

2.2 SQUARE AND RECTANGULAR DUCTWORK

A. Transverse and longitudinal duct seams reinforcement shall conform to appropriate tables and figures per SMACNA Velocity-Pressure Classification for duct construction.

1. Transverse joints shall be sealed with duct joint sealant. "Ductmate" or "Nexus" 4-bolt connection systems may be used in lieu of standard construction.

2. Field assembled longitudinal seams shall be sealed with duct sealant. Factory or shop fabricated rolled or machine pressed longitudinal seams does not require sealant.

B. Corner closures shall be required as described and illustrated by SMACNA Duct Construction Standards.

C. Throat radius on all elbows shall not be less than the dimension of the duct plane of radius. Where this cannot be maintained, use shorter radius with internal guide vanes, or square elbow with turning vanes.

D. Bracing and hanging of ductwork shall be per SMACNA Standards for size and system class of ductwork being used.

E. Any transformations shall not reduce the ductwork cross-sectional area. Maximum angle in straight duct, 20° for diverging flow and 30° for contraction flow. Transformation from square to round seams welded or brazed.

2.3 ROUND DUCTWORK

A. Standard Round Ductwork:

1. All spiral ducts shall have locked seams so made as to eliminate leakage under pressure for which this system has been designed. Longitudinal seams duct shall have fusion-welded butt seams.

2. No stovepipe will be allowed.

3. Round Ductwork Fittings:

a. All fittings fabricated per SMACNA Standards for round ductwork, material to match straight pieces of ductwork.

b. Fittings shall have continuous, welded seams.

c. 90° tees shall be conical type. 90° tees and 45° laterals up to and including 12 in. diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming. The entrance shall be free of any restrictions.

d. Round taps off the bottom of rectangular ducts down to diffusers shall be made with a 45° square to round shoe-tap.

4. Elbows:

a. Diameters 3 in. through 8 in.: Two-section stamped and continuously welded elbows, material to match straight pieces of ductwork.

b. Over 8 in.: Gored construction with standing seam construction and internally sealed or continuously welded. Less than 35° - two gores, 36° to 71° - three gores, over 71° - five gores.

c. Fabricated to a centerline radius of 1.5 times the cross-section diameter.

d. Adjustable elbows are not allowed.

5. Joints:

a. For duct construction pressure 3 in. w.g. or greater:

1) Round Joints:

a) Unexposed Duct 3 in. - 30 in. Diameter: Connect round duct with a one piece interior slip coupling, at least two gauges heavier than duct wall, beaded at center and fastener to duct with screws. Seal joint with an approved sealant applied continuously around both end of coupler prior to assembling and after fastening.

b) All Exposed Duct and Unexposed Duct 30 in. - 72 in. Diameter: Install using a three piece, gasket flanged-joint consisting of two internal flanges, with integral mastic sealant, and one external closure band, which compress the gasket between the internal flanges.

(1) Acceptable Manufacturer: Ductmate Industries "Spiralmate" system or approved equal.

c) Above 72 in. Diameter: Install using companion angle flanged joints as defined in Figure 3-1 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible" Third Edition. Refer to manual for proper sizing and construction details.

b. Pipe-to-pipe joints in diameters up to 60 in. shall be by the use of sleeve couplings, reinforced by rolled beads.

c. Pipe-to-fitting joints in diameters up to 60 in. shall be by slip-fit of projecting collar of the fitting into the pipe.

d. Insertion length of sleeve coupling and fitting collar shall be 2 in. up to 36 in. diameter and 4 in. above 36 in. diameter.

e. Pipe-to-pipe and pipe-to-fitting connections in ductwork above 60 in. in diameter shall be made by angle ring flanges. The flange on the pipe shall be a 2 in. x 2 in. x 3/16 in. angle attached to the pipe with a continuous weld. The fittings shall have a loose ring "Van Stone" flange. A 5/8 in. flange shall be provided to act as a gasketing surface for sealing with the angle ring being a rolled, welded ring 2 in. x 2 in. x 3/16 in. Bolt hole spacing for angle rings shall be 6 in. centers.

f. If longitudinal seam duct greater than 60 in. in diameter is supplied in lengths greater than 4 ft., one angle ring must be welded to the duct on 4 ft. centers for support.

2.4 DUCTWORK SEALING

A. SMACNA Duct Sealing Classification shall be used for duct systems using the following criteria:

1. Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A, as required to meet the requirements of SMACNA Duct Construction Standards and with standard industry practice, including transverse joints, longitudinal seams, fitting connections, and all penetrations of the duct wall.

2. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage. Pressure sensitive tape shall not be used.

3. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels and duct connections to equipment.

4. Sealing that would void product listings is not required.

5. Spiral lock seams need not be sealed.

B. Sealants and tapes shall be listed and labeled in accordance with UL 181A or UL181B and marked according to type, and per manufacturer product requirements for associated system and application/installation location.

1. Duct sealant for indoor applications shall be non-fibrated, water based, Hardcast Iron-Grip IG-601, Ductmate PRO Seal, Foster 32-17 or Childers CP146, or approved equal.

2. Duct sealant for outdoor applications shall be fibrated, water based, Hardcast Versa-Grip VG-102, Ductmate Fiberseal, Foster 32-17 or Childers CP148, or approved equal.

2.5 TURNING VANES

A. Provide in mitered elbows as shown on contract drawings. Vanes 36 in. or longer shall be double wall air foil type. All turning vanes shall be installed as per the latest SMACNA Standards. Turning vane size and spacing shall be as per SMACNA. Turning vane spacing greater than SMACNA Standards is not acceptable.

B. Turning vanes shall be Harper or equivalent double wall turning vanes fabricated from the same material as the duct.

C. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vane shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer's instructions.

D. Rails for mounting turning vanes shall have self locking, friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in Figure 4-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible". Rail systems with non-compliant tab spacing shall not be accepted.

E. Acoustical Turning Vane: Shall be used in applications that require quiet operating systems. Mounting rails shall have friction insert tabs that align the vanes automatically.

F. Acceptable Manufacturer: Ductmate Industries PRO-Rail Turning Vane or approved equal.

2.6 DAMPERS IN DUCTWORK

A. Blade Type Volume Dampers: Constructed per SMACNA, one gauge heavier than duct material, securely fastened to 3/8 in. sq., cold rolled steel operator rod. Provide stainless steel operator rod in stainless steel ductwork. Provide Ventlock 639 elevated dial regulator for 2 in. insulated ductwork or equal. Provide Ventlock 635 dial regulator for non-insulated ductwork or equal.

B. Multiple Blade Type Volume Dampers: Provide multiple blade volume dampers in ductwork above 12 in. in height.

1. Heavy duty, manual balancing dampers suitable for application in HVAC systems with velocities to 1,500 ft. per minute, open position and max. pressure of 3 in. w.g. close position. Ruskin MD 35 or equivalent.

2. Fabrication:

a. Frame: 5 in. x minimum 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel.

3. Blades:

a. Style: Single skin with 3 longitudinal grooves.

b. Action: Opposed.

c. Orientation: Horizontal

d. Material: Minimum 16 gauge equivalent thickness, galvanized steel.

e. Width: Nominal 6 in.

4. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.

5. Linkage: Concealed in frame.

6. Axles: Minimum 1/2 in. diameter, plated steel, hex-shaped, mechanically attached to blade.

7. Control Shaft: 3/8 in. square plated steel.

8. Finish: Mill galvanized.

a. Actuator: Hand quadrant for 3/8 in. square extended shaft.

b. Hand Quadrant Standoff Bracket: 2 in. standoff for insulated ductwork.

c. Oillite bearings.

d. Factory Sleeve: Minimum 20 gauge thickness, minimum 12 in. length.

C. Fire and Smoke Dampers: See "Fire and Smoke Dampers" Section.

D. Automatic Air Dampers: Furnished as part of "Building Management System" Section 230923, and installed by this Contractor.

E. Blast Gates: Aluminum housing, locking thumbscrew, galvanized slide blade. Provide stainless steel housing and slide blade in welded stainless steel ductwork.

2.7 FLEXIBLE AIR DUCTS

A. Flexible air ducts and connectors shall be constructed in compliance with NFPA Bulletin 90A, 90B and UL Standard 181 and shall be listed and labeled as Class I Air Duct.

B. Flexible air ducts and connectors shall be tri-laminate:

1. Consisting of corrosion resistant galvanized steel helix encapsulated by a double lamination of polyethylene or spun bond nylon.

2. Factory applied (R 6.0) fiberglass exterior insulation, sheathed in a seamless, tri-directionally reinforced, metalized polyester, exterior vapor barrier.

3. R-value shall be classified by Underwriters Laboratories, and certified by the Air Diffusion Council, in accordance with ADC Flexible Duct Performance and Installation Standard (1991), using ASTM C-518, at installed wall thickness, on flat insulation only. Comply with ASHRAE/IESNA 90.1.

4. Recommended operating pressure for flexible ductwork shall be three times maximum system press but not less than 6 in. w.g. positive pressure for 4 in. - 20 in. dia., 5 in. w.g. negative pressure through 16 in. dia., 1 in. negative pressure for 18 in. and 20 in. dia. Maximum velocity of 5500 fpm.

5. Operating temperature range - 20°F to 250°F, intermittent @1/2 in. pos. w.g. max., -20°F to 140°F, continuous at maximum pressure.

6. Flame Spread: 25 max. smoke developed rating: 50 max.

7. Porous inner core flexible duct shall not be used.

C. Static pressure and thermal performance shall be tested and certified in accordance with Air Diffusion Council (ADC) Test Code FD-72-R1 under conditions of 140°F for 164 hours and 180°F for 4 hours.

D. Acoustical performance shall be certified in accordance with ASTM E 477 and/or Air Diffusion Council Test Code FD-72-R1.

1. Minimum Acoustic Performance:

a. The insertion loss (dB) of a 6 foot length of duct when tested in accordance with ASTM E477 at a velocity of 1000 feet per minute shall be at least:

	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
8 inch dia.	26	27	27	31	32	27
12 inch dia	22	26	24	31	31	20

E. Friction loss and leakage for flexible duct only shall be certified in accordance with Air Diffusion Council Test Code FD-72-R1. Leakage for connections shall be accordance with UL 181 requirements.

F. Basis-of-Design: Flexmaster 6B (R-6.0).

G. Acceptable Manufacturers:

1. Dundas-Jafine Type SPC R6.0

2. Hart & Cooley Type F216 (R-6.0)

3. Flexible Technologies, Inc. Thermaflex Type M-KE (R-6.0)

4. Atco Rubber Products, Inc. Type 036 (R-6.0)

2.8 FLEXIBLE CONNECTIONS TO FANS AND EQUIPMENT

A. Basis-of-Design: Ventfabrics, Inc.

B. Acceptable Manufacturers: Ductmate Industries, Inc., Duro Dyne Inc., Elgen Manufacturing, Ward Industries, Inc.; a division of Hart & Cooley, Inc.

C. Materials: Flame-retardant or noncombustible fabrics, water and mildew resistant UL Standard 214.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 in. wide attached to two (2) strips of 2-3/4-in. wide, 0.028-in. thick, galvanized sheet steel or 0.032 in. thick aluminum sheets. Provide metal compatible with connected ducts.

F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.

2. Tensile Strength: 480 lbf/in. in the warp and 360 lbf/in. in the filling.

3. Service Temperature: Minus 40 to plus 200°F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-in. movement at start and stop.

2.9 ACCESS DOORS

A. General:

1. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

2. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.

3. Systems 3 in. w.g. or less shall utilize a hinged, cam, or hinged and cam square framed access door.

4. Systems 4 in. w.g. and above shall utilize a sandwich type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Third Edition.

5. Approved Manufacturer: Ductmate Industries "Sandwich" style door or approved equal.

6. All access doors shall be continuous piano hinged type, unless noted otherwise.

7. Non-hinged only allowed where clearance to ceiling does not allow a full 90° swing.

8. Double panel insulated type when used in insulated duct.

9. Single panel uninsulated type allowed in un-insulated duct.

10. Pressure rated according to system in which being installed. Door-to-frame and frame-to-duct gasketing.

11. Provide specified Seal Class A or B ductwork sealing around frame, and hand adjust the latch tension for proper seal, on all access doors other than sandwich panel (Ductmate) style.

12. MINIMUM access door size for ducts 12 in. or less in depth is 12 in. x 8 in.

13. MINIMUM access door size for ducts 12 in. to 18 in. in depth is 18 in. x 14 in.

14. MINIMUM access door size for ducts more than 18 in. in depth is 24 in. x 18 in.

15. In ducts which require multiple section fire dampers due to duct size, provide one access door for each fire damper section.

16. Access doors for fire and smoke dampers shall be permanently labeled with 1 in. high lettering reading "SMOKE DAMPER", "FIRE DAMPER" or FIRE/SMOKE DAMPER".

B. Door Types:

1. Low Pressure Systems (2 in. w.g. pressure class): National Controlled Air ADH-1, Ruskin ADH22, Vent Products 9701, Air Balance FSA-100, Safe Air SAH, Nailor.

2. Medium and High Pressure Systems (3 in. w.g. pressure class and higher):

a. Rectangular Duct: Ductmate Industries "Ultimate" Style Door, or equal.

b. Round Duct: Ductmate Industries Round Sandwich type, or equal. 8 in. x 4 in. for ducts 14 in. and less in diameter. Ductmate Industries Round Sandwich type 16 in. x 12 in. for ducts more than 14 in. in diameter.

c. Furnish and install factory supplied protector molding on cut medal edge for all Ductmate access doors.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Ventlock 699 or 699-2 based upon insulation thickness.

C. Install duct test holes where required for duct traverse testing and balancing purposes.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Equipment and systems shall be installed in accordance with local and state codes and regulations having jurisdiction. Bracing and hanging of ductwork shall be per SMACNA - HVAC Duct Construction Standard.

B. Install all ductwork concealed and tight to the structure above unless noted otherwise on shop drawings. Fabricate only after the approval of shop drawings, and in locations to avoid interferences.

1. Ductwork installed without approved shop drawings, which requires removal/modification and/or reinstallation due to conflicts or improper installation shall be repaired at no cost to the Owner.

C. Sizes given on contract drawings are inside dimensions.

D. The ductwork sizes and types (round and rectangular) were selected for space limitation and acoustical requirements within the building. In addition, the ductwork sizes and types were chosen to allow space above the ceilings for future ductwork, piping and/or conduit. It is not acceptable for the contractor to change the size or type of ductwork for bidding or installation unless specifically approved by the engineer.

E. Keep openings continuously closed and sealed with protective plastic wrapping during construction to prevent entrance of dirt and debris.

F. Extend access openings, damper rods and levers, to outside of external insulation make systems airtight.

G. No piping, conduit or other obstruction to airflow is permitted in ductwork.

H. Provide necessary openings, hanger inserts, framing, chases, and recesses, not provided by other trades.

I. Exposed exhaust or return registers and grilles shall be flush with face of duct; exposed supply registers and grilles shall be mounted outside airstream with 45° shoe-tap extension collars.

J. Where a return or exhaust duct is shown to be left open ended, provide hardware 05 inch aluminum mesh screen at opening.

K. Do not utilize flexible ductwork or connection in any way to connect variable or constant volume boxes to ductwork.

L. Penetrations:

1. Provide 14 gauge sleeves for ducts passing through Mechanical Room floors. Set sleeves 4 in. above finished floor in Mechanical Rooms, seal watertight to floor.

2. For duct penetrations of non-rated walls, provide sheet metal angle framing or sheet metal closure panels around the entire perimeter of each duct wall penetration on both sides of the wall, where the gap exceeds 1/4 inch. Where the gap is less than 1/4 inch, the gap may be caulked on both sides of the wall. Non-rated wall penetrations SHALL NOT be fire caulked under any circumstances.

3. For duct penetrations of rated walls, see Specification Section 230500 - Basic Mechanical and Electrical Requirements.

M. Ductwork that is called for to be welded shall be fully welded, continuous around the entire perimeter at all joints/seams, and shall be fully airtight and watertight.

3.2 FLEXIBLE CONNECTIONS

A. Provide flexible connections for the intake and discharge connections of duct connected to fans and air handling equipment.

B. Round connections are to be made with adhesive and metal drawbands with ends tightly bolted.

C. Rectangular connections shall be made with material securely held in grooved seam between flanges. Attach with adhesive and mechanical fasteners on 6 in. centers.

D. Connections shall be made with a minimum of 2 in. space between duct and equipment collars, installed in line, and with 1 in. excess material folded so as not to interfere with airflow through connection.

E. Mechanically fastened and sealed, with specified duct sealant, at duct and equipment connections.

3.3 TEST OF DUCTWORK

A. Conduct duct leakage tests per SMACNA "HVAC Air Duct Leakage Test Manual" and per the requirements of the Energy Conservation Construction Code of New York State, for ductwork systems as indicated below.

Positive pressure leakage testing is acceptable for negative pressure ductwork. The rate of air leakage (CL) must be less than or equal to 4.0 for rectangular ductwork and 2.0 for round ductwork, as determined by the equation in the code referenced above, which reads: $CL=F/P^{0.65}$ where F = measured leakage rate in CFM per 100 sq. ft. of duct surface, and P = static pressure of the test. When leakage above stated limits occurs, ascertain location of leaks and rebuild, repair, or seal the ductwork as required. Repeat tests as required to obtain allowable leakage rates. Prepare a report similar to that suggested by SMACNA and submit for review.

B. Leakage testing shall be witnessed by representatives from Cornell University and the Project Engineer of Record.

C. Systems designed to operate at static pressures of 3.0" w.c. and below: All risers and main ductwork upstream of terminal units to be tested. 25% of the remaining 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 selections fail the leakage test, another 25% of the duct system shall be chosen to be tested. If any of the second 25% fails, the entire duct system shall be leakage tested.

D. Duct Leakage testing acceptance criteria: Generally, maximum system leakage shall be specified by the Consultant per the following recommendations:

1. Interior supply, return and general exhaust systems: 5% system leakage, tested at 1.25 times the expected operating static pressure.

2. Interior Laboratory exhaust systems: 2% system leakage, tested at 1.25 times the expected operating static pressure.

E. Systems designed to operate in excess of 3-inches w.c.: The entire system shall be leak tested.

F. Provide test reports indicating pressure tests performed. Include date, section tested, test pressure and leakage rate.

G. Ductwork not required to be tested for leakage, shall be checked and guaranteed to meet the standards of the specified SMACNA Duct Seal Class A. All joints and connections on this ductwork shall be sealed using the approved ductwork sealant. Air balancing and testing shall be used to determine satisfactory operation of duct systems. Balancing reports indicating excessive leakage amounts shall be required to rebuild, repair or seal ductwork having excessive leakage.

3.4 INSTALLATION OF ROUND DUCTWORK

A. Use factory-fabricated couplings for joints.

B. After the joint is slipped together, sheet metal screws are placed 1/2 in. from the joint bead for mechanical strength.

C. Sealer is applied to the outside of the joint and covering the screw heads.

D. Flanged joints shall be made with neoprene rubber gaskets.

3.5 DUCT SEALING

A. Preparation:

1. Clean surfaces of dirt, oil, grease and loose of foreign matter that could impair adhesion, using soap and water or solvent.

2. Allow surfaces to dry completely before proceeding.

B. Installation of Sealant System:

1. Apply sealant system to duct joints, fasteners, and seams in accordance with manufacturer's instructions.

2. Apply sealant by brush, putty knife or caulk gun, to full coverage. Remove excess adhesive immediately.

3. Completely seal duct joint, fasteners and seams without voids, to a minimum 20 mil thick wet film.

4. Apply and store at ambient temperature of 40°F to 100°F; and protect from freezing until dry.

C. Field Quality Control:

1. Allow duct sealant system to cure a minimum of 72 hours before operating the system.

2. Do not apply external duct insulation or coatings until the joints have been inspected by the Owner's Representative.

3.6 TURNING VANES

A. Install only in square elbows.

B. Install as per latest SMACNA Standards.

C. Secure vane runners to duct with spot welding, riveting or sheet metal screws.

D. When installing in ductwork with internal insulation.

1. Install runners in ductwork inside insulation and bolt through insulation and duct sides, welding bolts to insure rigid installation. Provide build-outs for duct Velocity-Pressure classes above 2 in. w.g.

3.7 DAMPERS AND AIR CONTROL DEVICES

A. Provide volume dampers at all air outlets, diffusers, grilles and as noted on plans. Provide volume dampers at all low pressure supply, return and exhaust, branch ducts and as noted on the plans.

B. Provide dampers necessary to permit proper balancing of air quantities. Comply with code requirements for smoke and fire control. Prevent introduction of uncontrolled outside air into building through roof and wall openings.

C. When dampers are installed in acoustically lined ductwork, install with insulated "build-outs" per SMACNA.

D. Install fire and smoke dampers in accordance with "Fire and Smoke Dampers" Section and applicable codes.

E. Install all dampers furnished as part of "Building Management System" Section.

3.8 FLEXIBLE AIR DUCTS

A. "Air duct" applies to conduit or passageway for conveying air to or from heating, cooling, air conditioning or ventilating equipment but not including the plenum as defined in NFPA 90A. "Air connector" applies to conduit for transferring air between an air duct or plenum and an air terminal device or an air inlet or an air outlet as defined by the NFPA 90A.

B. For round to oval connections, provide round-oval flexible adapter.

C. Flexible air ducts and connectors shall be provided in fully extended condition, free from kinks.

D. Flexible air ducts and connectors shall not be used in systems with entering air temperatures in excess of 250°F.

E. Flexible air ducts and connectors shall use only the minimum length required to make the connection and shall be installed in the horizontal or vertical position. Flexible elbows are not acceptable. Do not exceed a maximum length of 36 in., fully extended.

F. Flexible air ducts and connectors shall use minimum 1/2 in. wide positive locking, steel worm drive clamp, or nylon plenum rated straps for joints and connections. One clamp or strap for the inside core liner and one clamp or strap for the outer jacketing. When non-metallic (nylon) straps are used, they should be listed and labeled to standard UL 181B. Fastener package should be marked UL 181 B-C.

G. Collars to which flexible duct is attached shall be beaded and a minimum of 2 in. in length. Wrap twice with UL 181 tape and secure with clamp or strap. Sleeves used for joining two sections of flexible duct shall be beaded and a minimum of 4 in. in length. The draw band shall be positioned behind the bead on the metal collar.

H. Outer vapor barrier and insulation shall be slid over inner core and collar, wrapped twice with UL 151 tape and secured with a clamp or strap.

I. Connections shall be per SMACNA "HVAC Duct Construction Standards - Metal and Flexible", Air Diffusion Council "Flexible Duct Performance and Installation Standards" and NAIMA Installation Standards.

J. Flexible duct shall be supported at manufacturer's recommended intervals, but no greater distance than 2'-6" on center and prior to all 90 degree bends. Maximum permissible sag shall be 1/2 in. per foot of support spacing. Provide a minimum of one hanger on each run of flexible duct.

K. A connection to rigid duct or equipment shall be considered a support joint. Long horizontal duct runs with sharp bends shall have additional supports before and after the bend approximately one duct diameter from the centerline of the bend.

L. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case shall the material contacting the flexible duct be less than 1-1/2 in. wide. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when the manufacturer's recommended procedures are followed.

M. The hanger shall be strapped around the flexible duct and secured to the structure above. Hangers shall not be attached to other mechanical or electrical objects. Hangers may be attached to an approved trapeze. Ceiling grid shall not be used to fabricate a trapeze. Support hangers shall be installed horizontal. Screws shall not be used to penetrate the flexible duct to attach to the hanger.

N. Provide flexible duct connections and splices in accordance with manufacturer's recommended installation instructions.

O. Seal flexible duct connections with sealing materials listed and labeled in accordance with UL 181B. Mechanically secure connections with approved clamping materials.

3.9 FLEXIBLE CONNECTIONS TO FANS AND EQUIPMENT

A. Provide flexible connections for the intake and discharge connections of duct connected to fans and air handling equipment.

B. Round connections are to be made with adhesive and metal drawbands with ends tightly bolted.

C. Rectangular connections shall be made with material securely held in grooved seam between flanges. Attach with adhesive and mechanical fasteners on 6 in. centers.

D. Connections shall be made with a minimum of 2 in. space between duct and equipment collars, installed in line, and with 1 in. excess material folded so as not to interfere with airflow through connection.

E. Mechanically fastened and sealed, with specified duct sealant, at duct and equipment connections.

3.10 DUCT CLEANLINESS AND CLEANING AFTER INSTALLATION

A. Duct Cleanliness:

1. All ductwork on the project shall meet the SMACNA Duct Cleanliness For New Construction Guidelines, "Advanced Level" of duct cleanliness for production, delivery, storage and installation of ductwork.

2. Prior to shipment to the jobsite, all duct ends and openings must be covered with a heavy duty, dual-ply, clear polyethylene protective film. Open ends are to be kept covered during transport, storage, and installation. As ductwork is installed at the job site, open ends are to be covered to maintain cleanliness.

3. The film must be securely affixed to protect against dirt and debris, and must be translucent to facilitate inspection of interior surfaces without removing the film. The film is have a elongation rating of 600% and a break strength of 13.1 lbs./in. The film shall contain no VOC's, and shall leave no residue on duct after removal.

4. Manufacturer: Ductmate Industries ProGuard (heavy duty grade clear).

B. Cleaning After Installation:

1. Interior surfaces shall be free of dust and debris prior to initial start up. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes. Any cleaning of duct systems shall comply with recommendations of NAIMA and NADCA.

2. Clean external surfaces of foreign substances that might cause corrosion, deterioration of the metal, or where ductwork is to be painted.

3. Clean debris from system before fans are turned on.

4. Keep openings continuously closed during the construction period.

5. Pay damages resulting from dirt blown on painted or other finished surfaces.

6. Repair or replace damaged fan wheels, dampers, or other system parts damaged as a result of debris.

7. Clean system as many times as required until the entire system is dirt free.

3.11 ACCESS DOORS

A. Provide for access to upstream side of duct mounted reheat coils, dampers, damper motors, fire dampers, smoke dampers, smoke detectors, control devices, fan bearings, and equipment requiring periodic inspection or service. Provide labels for fire and smoke dampers as called for in Part 2 - Products.

B. For ducts that are too small to install an access door of the minimum specified size, provide a 12" long section of removable ductwork for maintenance and inspection access. Removable ductwork shall be fastened between device requiring access and next duct section with duct flanges or Donaldson Torit clamp with PVC foam seal. For ducts that are required to be insulated, provisions shall be made to allow insulation to be easily removed and re-installed.

3.12 DUCT SUPPORTS

A. Provide per SMACNA, same material as duct. Hanger bands to extend down sides and turn under bottom 2 in. Minimum two metal screws per hanger. Angle iron on larger duct spaced per building structural system but not greater than 8 ft. Provide extra support angles as required.

B. Provide additional supports as required to support reheat coils, air terminal units, filter enclosures, and any other duct mounted equipment independent from the associated ductwork system.

3.13 SMOKE DETECTION

A. Smoke detectors shall be furnished by Division 28 " Electronic Safety and Security". This Contractor shall install detectors located in ductwork. Clearly indicate locations of smoke detectors on the sheet metal shop drawings.

B. Increase duct size at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size required with Division 28 " Electronic Safety and Security".

EXHIBIT I - DUCTWORK MATERIALS

SERVICE	MATERIAL	SPECIAL REQUIREMENTS
Supply, return, vent, relief, outside and exhaust	Lock forming quality, galvanized steel ASTM A653 and A924, galvaneal/paint grip if not insulated and exposed	Joints and features as called for
Accessories, dampers and air turns	Same material and gauge as parent duct	----------
Field constructed apparatus casings	Galvanized steel ASTM 525	Sealed airtight

END OF SECTION

FIRE AND SMOKE DAMPERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation, testing and certification as shown on the Contract Documents.

1.2 SUBMITTALS

A. Submit product data, types, schedule of sizes, locations, and installation arrangements of all dampers.

B. Submit manufacturer's UL listed installation details for each mounting arrangement.

1.3 QUALIFICATIONS

A. Provide work in compliance with the following Codes and Standards based on the current edition in effect at project location:

1. Mechanical Code of New York State.

2. UL 555, UL 555S and UL555C.

a. Fire dampers shall be Underwriter's Laboratories classified and labeled.

b. Smoke dampers and operator assemblies shall be Underwriter's Laboratories (UL) classified and labeled as an assembly.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

A. Curtain type damper of galvanized steel (304 stainless steel for ductwork containing shower room exhaust, wet location exhaust, and corrosive fume exhaust) construction with fusible link, 20-gauge frame and 24-gauge blades. UL listed and labeled.

1. 100% free area with welded head for velocities above 2000 fpm**.**

2. Square, rectangular, round or oval duct connection as required by duct connections.

3. 1-1/2 hour rated dampers for walls or floors rated less than three hours. Three-hour rated dampers for three and four hour walls or floors.

4. With factory fabricated sleeve with fixed and slip flanges.

5. Fusible link temperature rating of 165°F.

B. Design Equipment: Ruskin Model IBD2 Style B.

C. Make: Ruskin, Air Balance, National Controlled Air, Greenheck, Nailor.

2.2 COMBINATION FIRE/SMOKE DAMPERS

A. Airfoil multiblade type damper of galvanized steel construction suitable for installation in high velocity duct systems up to 3000 fpm and 4 in. s.p. with 16 gauge hat channel frame with corner reinforcement and blades equivalent to 14 gauge, silicone rubber blade edge seals, stainless steel bearings and flexible stainless steel jamb seals. UL listed and labeled. Associated smoke detectors by Division 26 to coordinate with the Fire Alarm System.

1. UL listed 120 volt electric motor operator. Operator to be mounted outside of the air stream. Provide damper with two auxiliary contacts for monitoring by the BMS system.

2. Square, rectangle, or round as required. Duct transitions for dampers in oval ducts.

3. With factory fabricated sleeve with fixed and slip flanges.

4. Class I leak rating of 4.0 cfm/ft^2 at 1 in. w.g. (8.0 cfm/ft^2 at 4 in. w.g.)

5. 1-1/2 hour fire rated. Fusible link temperature rating of 165°F.

6. Provide with remote damper test switch package and open/closed position light indicators.

B. Design Equipment: Ruskin FSD60.

C. Make: Ruskin, Air Balance, National Controlled Air, Greenheck, Nailor.

2.3 CEILING RADIATION DAMPERS

A. Ceiling radiation dampers shall conform with NFPA 90A, UL 555C, BSA, CSFM and applicable building codes.

1. The damper frame shall be constructed of 24 gauge galvanized steel.

2. The blades of the damper shall be two piece, single thickness with blade insulation, hinged in center, held open with a fusible link, constructed of 24 gauge galvanized steel, and have a butterfly action.

3. Fusible link temperature rating of 165°F [212 °F]

B. Accessories:

1. UL classified damper blades shall be adjustable to balance airflow and close in fire conditions.

2. Provide extended frame as required based on installation requirements and to permit installation in flexible or hard duct applications.

C. Design Equipment: Ruskin Model CFD.

D. Make: Ruskin, Greenheck, Pottorff or approved equal.

PART 3 - EXECUTION

3.1 LOCATIONS

A. Provide fire dampers in all one, two and three hour-rate wall and floor penetrations, as called for.

B. Provide smoke dampers as called for in penetrations of smoke barriers.

3.2 INSTALLATION

A. Dampers shall be installed in accordance with the manufacturer's written instructions and as required to meet specified listings.

B. Provide sleeve, angles, and access doors for installation in accordance with the latest requirements of SMACNA, NFPA, UL and damper manufacturer.

C. Provide sheet metal access doors with labels, as called for in Specification Section 233100 in ductwork for dampers and accessories.

D. Install dampers square and free from racking.

E. Do not compress or stretch the damper frame into the duct or opening.

F. Provide bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Attach multiple damper section assemblies together in accordance with manufacturer's instructions. Install support mullions as reinforcement between assemblies as required.

G. Division 26 "Electric" will provide signal wiring and power wiring for smoke dampers. Refer to "Building Management System" Section for additional requirements. Smoke detectors shall be furnished by Division 28 "Electronic Safety and Security". Install detectors located in ductwork within 5'-0" of the damper. Increase duct size at smoke detectors, where required for proper installation, per smoke detector manufacturer's recommendations. Coordinate minimum duct size and length for smoke detectors required with Division 28 "Electronic Safety and Security". Locate remote damper test switch package near duct smoke detector test switch.

3.3 CERTIFICATION

A. Contractor shall certify that dampers are accessible for servicing, are installed properly, and are operational. Submit three (3) copies of signed certification to the Owner's Representative for review.

3.4 IDENTIFICATION

A. Provide damper tags and charts.

1. Fasten tag to ductwork adjacent to the dampers.

2. Number each damper and make chart listing.

a. Number.

b. Location.

c. Air system in which they are installed.

B. Submit three (3) copies of chart to the Owner's Representative for review.

END OF SECTION

FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Drawings.

1.2 SUBMITTALS

A. Submittals shall include all fans, motors, drives, and accessories. Include all fan curves fan operating point and sound data.

1.3 QUALITY ASSURANCE

A. Capacity, size and arrangement, static pressure, brake horsepower, component parts and accessories shall be provided as called for or scheduled. Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. The manufacturer shall guarantee sound-power level ratings not exceeding those of the design equipment. All equipment shall be statically and dynamically balanced to acceptable tolerances with weights permanently fastened. Fan wheels shall be rebalanced in the field, if necessary.

B. Pressure Classification:

Maximum Total Sp	Class
Up to 3-3/4 in. WG-STD	I
Up to 6-3/4 in. WG-STD	II
Up to 12-3/4 in. WG-STD	III

C. Motors:

1. Motor sizes shall be as scheduled. Refer to Specification Section 230513 for motor types, efficiency requirements, and acceptable motor manufacturers. All belt-driven fan motors shall be mounted on either an adjustable slide base or a pivoting base. Motors shall contain permanently lubricated sealed ball bearings.

D. Drive Systems:

1. Provide fans with belt or direct drive systems as scheduled. V-belt drives as recommended by drive manufacturer, unless otherwise specified or scheduled.

a. Size drive for 200% of motor rating when motor is 10 HP and larger. Size for 150% of motor rating when motor is less than 10 HP.

b. Motors 5 HP and larger shall be provided with a minimum of two (2) belts. All belt sets shall be matched.

c. Cast iron or cast steel pulleys.

d. Provide belt and shaft guards for each driven device. Provide openings in both the motor and fan sections of the guard so that the motor and fan speeds can be checked without removing the belt guard.

e. Belts shall be oil and heat resistant, non-static type.

f. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts.

g. All belt drive fan motor selections must include an allowance for medium drive losses as established by AMCA Publication 203.

E. Motor Pulleys:

1. 5 HP and Smaller: Adjustable type to produce 15% speed change above and below scheduled fan speed. 7-1/2 HP and Larger: Fixed type.

2. 5 HP and Smaller: "A" section, 2.6 in. minimum pitch diameter.

3. 7-1/2 HP to 20 HP: "B" section, 4.6 in. minimum pitch diameter.

4. 25 HP and Larger: "C" section 7.0 in. minimum pitch diameter.

5. Drive ratio not over 4:1.

F. Bearings:

1. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy-duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours as maximum cataloged operating speed.

G. Wheels and Propellers:

1. All wheels and propellers shall be balanced in accordance with AMCA Standard 204-96, balance quality and vibration levels for fans. Wheel shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency.

2. Blades on all sizes shall be continuously welded to the backplate and deep spun inlet shroud.

3. All hubs shall be keyed and securely attached to the fan shaft.

H. Blower Shafts:

1. All blower shafts shall be AISI-C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum cataloged operating speed.

I. Vibration isolation for units shall be furnished by the fan manufacturer unless otherwise noted.

J. Certifications:

1. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (CUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

2. All units shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit-tested packaging.

PART 2 - PRODUCTS

1. CENTRIFUGAL BLOWER/CENTRIFUGAL VENT SETS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Greenheck, Cook, Twin City, PennBarry.

B. Ceiling, Direct Driven, Centrifugal Exhaust Fan:

1. Construction:

a. The fan housing shall be minimum 20 gauge galvanized steel and acoustically insulated.

b. Blower and motor assembly shall be mounted to a minimum 14 gauge reinforcing channel. Motor shall be resiliently mounted.

c. Unit shall be supplied with integral wiring box.

d. Discharge position shall be convertible from right angle to straight through by moving interchangeable panels. The outlet duct collar shall include reinforced aluminum dampers with continuous aluminum hinge rods and brass bushings. To accommodate different ceiling thickness, an adjustable prepunched mounting bracket shall be provided.

e. A powder painted white steel grille shall be provided as standard.

2. Wheel:

a. Wheels shall be twin DWDI centrifugal forward curved type, constructed of galvanized steel.

3. Accessories:

a. Disconnect switch - Factory mounted and wired.

b. Fan Speed Controller (For Direct Drive Models Only) - Factory mounted and wired.

4. Basis-of-Design: Product indicated in schedule.

2.1 INLINE BLOWERS/INLINE FANS

A. Manufacturers: Subject to compliance with requirements of this section, provide products by one of the following:

1. Acme, Cook, Greenheck, New York Blower, Twin City, PennBarry.

B. Square Centrifugal Blowers:

1. Construction:

a. The fan shall be bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral inlet and outlet flanges.

b. Pivoting motor plate shall utilize threaded L-studs for positive belt tensioning.

c. Bolted access doors shall be provided on three (3) sides, sealed with close cell neoprene gasketing.

d. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation.

2. Wheel:

a. Wheel shall be aluminum, non-overloading, centrifugal backward inclined, flat blade type. Hub shall be cast and precision machined, also constructed of 100% aluminum.

3. Accessories:

a. AMCA "B" spark resistant construction per AMCA 99-0401.

b. Inlet/Outlet Companion Flange.

c. Inlet/Outlet Flex Duct connector.

d. Disconnect Switch - Factory wired and mounted.

4. Basis-of-Design: Product indicated in schedule.

C. Mixed Flow Inline Fans:

1. Construction:

a. The fan shall be bolted and welded construction utilizing corrosion resistant fasteners. The steel drum shall be minimum 14 gauge steel with companion inlet and outlet flanges constructed of minimum 1-1/2 in. x 1-1/2 in. x 1/8 in. angle.

b. External lube lines shall be furnished for lubrication of fan bearings.

2. Fan Wheel:

a. Fan wheels shall be mixed flow design with die-formed blades designed for maximum efficiency, and quiet and stable operation. Blades shall be continuously welded to the back plate and wheel cone. Wheels shall be statically and dynamically balanced and the complete fan assembly including motor and drive shall be test balanced at or near the operating speed at the factory prior to shipment.

3. Accessories:

a. Disconnect Switch - Factory wired and mounted.

b. Inlet/Outlet Companion Flange.

c. Hanging Brackets.

d. Bolted Access Door.

4. Basis-of-Design: Product indicated in schedule.

D. Ceiling Mounted, Direct Driven, Centrifugal Exhaust Fan:

1. Housing:

a. The fan housing shall be minimum 20 gauge galvanized steel and acoustically insulated.

b. Square outlet, field rotatable from horizontal to vertical discharge.

c. External electrical access.

2. Motor:

a. Motor enclosure shall be open driproof (ODP), opening in the frame body and or end brackets.

b. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase.

c. Motor shall be mounted on vibration isolators and be accessible for maintenance.

d. Thermal overload protection.

3. Grille:

a. A powder painted white polystyrene grille shall be provided as standard.

4. Wheel:

a. Wheels shall be centrifugal forward curved type, constructed of galvanized steel.

5. Accessories:

a. Disconnect switch - Factory mounted and wired.

b. Fan Speed Controller - Factory mounted and wired.

6. Basis-of-Design: Product indicated in schedule.

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

A. Provide equipment in accordance with manufacturer's instructions. All fans shall meet the intent of the system performance requirements. Provide rubber in-shear vibration isolation for all fans unless otherwise called for. Provide necessary support steel for equipment. Provide guards for all exposed belts, shafts, and fan wheels. Change pulley sizes or adjust sheaves as required to make systems deliver specified quantities of air as listed on the Contract Drawings.

END OF SECTION

VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation as shown on the Contract Drawings.

1.2 SUBMITTALS

A. Submit product data for terminal units including room number, maximum and minimum CFM, accessories, pressure drops, discharge and sound power data by octave band. Clearly indicate box sizes being proposed. Submit separately the controller and control interface devices being utilized.

PART 2 - PRODUCTS

2.1 TERMINAL UNITS

A. General Unit Construction:

1. Unit casing shall be constructed of 22 gauge welded galvanized steel. Factory label each unit with size, location, minimum and maximum CFM, and calibration chart. Air terminal units shall be capable of operating at 10 in. w.g., pressure maximum without damage. Maximum casing leakage at 3 in. W.G. shall be 11 cfm.

2. Unit insulation liner shall comply with the requirements of UL 181 (erosion, mold growth and humidity) and ASHRAE 62.1, and shall have a maximum flame/smoke spread of 25/50 for both the insulation and the adhesive when tested in accordance with ASTM E84. Insulation shall be secured with adhesive. Liner shall be:

a. Fiber-free foam insulation 1 in. thick (R4.0)

3. Units to be certified under ARI Standard 880-94 Certification Program and carry ARI seal.

4. Units to be provided with a factory control enclosure suitable for field installed controls.

5. Units shall be provided with factory access door option.

6. Units shall be provided with 3 ft. integral sound attenuators, where noted.

B. Control and Volume Regulating Devices:

1. Internal unit damper shall be constructed of galvanized steel with blade-end seals for tight shut-off with a maximum damper leakage of 7 CFM against a maximum of 3 in. w.g. Damper shall be mounted on a galvanized steel shaft extending through the unit on torque free bearings. Terminal shall have normally open dampers. Minimum and maximum air quantities shall be factory set, but may be field adjustable. Neither the radiated or discharge sound power levels shall exceed the ratings of design equipment as scheduled on the Contract Drawings.

C. Hydronic Reheat Coil:

1. Coil shall be factory installed on the terminal unit and shall be constructed of 1/2 in. copper tube with aluminum plate fins, nonferrous headers and connections. Tested at the factory to 250 PSI hydrostatic pressure. Control valves shall be provided by the temperature control subcontractor as described in Section 230923. Output capacity and rows as scheduled on the Contract Drawings.

D. Terminal Volume Controller (Microprocessor Based):

1. Provide unit with airflow velocity and total pressure sensor suitable for up to 3000 fpm inlet velocity. Sensor shall be averaging type with multiple sampling points on cross grids.

2. Wall mounted thermistor type electric space sensor provided by Control subcontractor.

3. The VAV box manufacturer shall provide the box and the airflow sensor. The temperature control subcontractor shall field install the microprocessor-based controller and damper motor.

E. Design Equipment: Titus DESV.

F. Acceptable Makes: Anemostat, Envirotech, Price, Krueger, Titus.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Suspended terminal units from the building structural system independent of the ceiling system. If this cannot be accomplished, provide additional intermediate angle iron from which the units shall be suspended. Level each unit.

B. Access to the terminal unit controls shall be accomplished by removal of ceiling panels or through an access door. Coordinate locations of access doors.

END OF SECTION

REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS

A. Registers/Grilles/Diffusers: Submit product data including room schedule listing size, CFM, throw, direction of throw, accessories, finish, material type, color chart, pressure drop and noise criteria.

1.3 GENERAL REQUIREMENTS

A. Each manufacturer shall check noise level ratings for registers and diffusers to insure that the sizes selected will not produce noise to exceed N.C. - 24, measured at occupant level; notify Owner's Representative of problems prior to submittal.

B. Pressure drop, airflow and noise criteria selection is based on design equipment. Manufacturers not submitting design makes must provide written certification in front of submittal that equipment submitted has been checked against and performs equal to the design make.

C. Borders and frames shall be coordinated with materials and ceiling systems to integrate with architectural ceiling details and finishes scheduled.

D. Locations of ceiling mounted air terminal devices shall be coordinated with locations shown on architectural reflected ceiling plans.

E. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw and pressure drop. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

1.4 REQUIREMENTS FOR REGISTERS

A. General:

1. A register is defined as a grille plus a volume damper.

2. Registers shall be installed "sight-proof" where possible, i.e.: High wall register with horizontal blades inclined up, or along a wall with blades facing the wall.

3. Borders and frames shall be of the same material as register face unless specified otherwise.

B. Mounting Frames:

1. Provide with screw holes in register face punched and countersunk at factory, and mounting frame drilled and tapped to suit, unless otherwise noted. Sponge rubber gasket between frame and wall or ceiling for all surface mounted frames.

2. Frame shall be overlap type and shall be suitable for type of ceiling where register is to be installed.

C. Finishes:

1. Baked enamel (of colors as selected from the manufacturer's standard color chart) as scheduled, unless otherwise noted.

D. Design Equipment: Titus unless otherwise noted.

E. Manufacturers: Krueger, Titus, Price, Tuttle and Bailey, Nailor.

1.5 REQUIREMENTS FOR DIFFUSERS

A. General:

1. Provide four way blow unless otherwise noted.

2. Where manufacturer's size recommendations require duct sizes or connections differing from design, Contractor shall provide at no change in contract price.

3. Suitable for recessed mounting unless otherwise indicated.

4. Provide square to round neck transitions as required.

5. Provide sponge rubber gasket for all surface mounted frames.

B. Finishes:

1. Baked enamel (of colors as selected from the manufacturer's standard color chart), as scheduled.

C. Frame style shall be suitable for ceiling type in which diffuser is to be installed.

D. Design Equipment: Titus unless otherwise noted.

E. Manufacturers: Krueger, Titus, Price, Tuttle and Bailey, Nailor.

PART 2 - PRODUCTS

2.1 SUPPLY TYPES

A. Type 1 - (Square Face Type):

1. Steel 22 gauge construction with round neck.

2. Directional flow pattern as indicated.

3. Frame suitable for ceiling type.

4. 1-3/4 in. deep inlet collar for duct connection.

5. Panel Size: 24 in. x 24 in.

6. Model: Titus TMS.

B. Type 2 - (supply air grille):

1. Steel 20 gauge frame construction with double deflection capability and the front blades shall be parallel to the long dimension. Solid extruded aluminum air foil blades mounted in friction pivots for individual blade adjustment, spaced on 3/4 in. centers.

2. 1-1/4 in. wide flange with sponge rubber gasket.

3. Model: Titus 272-RL.

2.2 RETURN/EXHAUST TYPES

A. Type A - (exhaust and return grilles):

1. Steel construction with 22 gauge frame and blades, with horizontal bars on a 1/2 in. spacing set at 35° fixed deflection.

2. 1-1/4 in. wide flange.

3. The blades shall be parallel to long dimension.

4. Provide with return air canopy for non-ducted return grilles.

5. Model: Titus 355-RL.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment in strict accordance with manufacturer's instructions. Rough in or install per reflected ceiling plan or in location instructed by Owner's Representative.

B. Provide approved air extractors behind all duct mounted supply registers in exposed ductwork.

C. When the final connection to an exhaust or return grille is made, a 12 in. minimum height plenum box must be supplied to all grilles. Plenum dimensions shall match grille size. Paint inside of plenum box flat black. Provide 1 in. acoustical lining in plenum box. Oversize the plenum to account for the thickness of the lining.

D. Seal all supply and return registers, grilles and diffusers during construction operations to limit dust entering HVAC systems and ductwork. Seals may be removed just prior to testing and balancing, but not without the approval of the Owner's Representative.

END OF SECTION

LOUVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services required for the complete installation designed in Contract Documents.

1.2 SUBMITTALS TO THE ARCHITECT/ENGINEER

A. Louvers including all blade types, finishes, and arrangements.

B. Penthouses including materials, finishes and accessories.

C. Provide original color charts for selection of finish.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Factory constructed high performance drainable, fixed, extruded aluminum 4 in. deep louvers.

B. Provide mullions where blade lengths exceed 60 in.

C. Sill extension and sill style as required by job conditions.

D. Louver to be flanged or un-flanged as required for the wall type in which it will be installed.

E. Heads, sills and jambs to be one piece structural members of 6063-T6 alloy with integral caulking slot and retaining beads.

F. Mullions shall be sliding interlock with internal drain(s).

G. Blades to be one piece extrusions with gutter(s) designed to catch and direct water to jamb and mullion drains.

H. Minimum extrusion thicknesses shall be as follows: Heads, Sills, jambs and mullions: 0.081". Fixed Blades: 0.068"

I. Closed cell PVC compression gaskets shall be provided between bottom of the mullion or jamb and the top of the sill to insure leak tight connections.

J. All fasteners to be aluminum or stainless steel.

K. All louvers to be furnished with 5/8 in. flattened expanded mesh, aluminum bird screen with a .055 in. thick extruded aluminum frame. Screens and screen frames to be standard mill finish.

L. All louvers shall be finished with powder coating of a color to be selected at the time of submittal review. Coating to be 1.5 to 3 mil. thick full strength 100% resin Fluoropolymer coating. Finish to adhere to a 4H Hardness rating. The louver manufacturer shall supply an industry standard 20-year limited warranty against failure or excessive fading of the Fluoropolymer powder coat finish.

M. Design Equipment: Construction Specialties A4177.

N. Makes: Construction Specialties, Inc., American Warming & Ventilating Inc., Arrow United Industries, Louvers & Dampers, Inc., Ruskin, Nailor, Greenheck.

PART 3 - EXECUTION

3.1 GENERAL

A. Install louvers and penthouses as per manufacturer's recommendations.

3.2 LOUVERS

A. Size called for is approximate wall/or masonry opening size. Adjust slightly to suit construction or coursing (review architectural drawings or field conditions for rough opening sizes.) Slope ductwork, and plenum to louver weephole or provide drain.

B. Structural supports shall be designed and furnished by the louver manufacturer to carry a wind load in accordance with the 2025 Building Code of New York State.

END OF SECTION

AIR FILTERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents. Install equipment in strict accordance with manufacturer's instructions, and as detailed on the Contract Documents.

1.2 SUBMITTALS

A. Filter product data including certification date, pressure drops at the scheduled airflow, schedule of filter sizes for each system. All filter accessories, including framing systems, fastening clips, manometers, and differential pressure gauges.

B. Provide product test reports for each listed efficiency including all details as prescribed in ASHRAE Standards 52.1 and 52.2 including testing per Appendix J.

1.3 QUALITY ASSURANCE

A. Filters shall comply with the requirements of ASHRAE Standard 52-76, and UL Standard 586-Class II requirements. Filters shall also comply with requirements of applicable State and federal agencies. Filters shall not exceed a flame spread rating of 25 and smoke development rating of 50.

B. Manufacturer shall provide evidence of facility certification to ISO 9001: 2008.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MAKES

A. Freudeberg Filter Division/Viledon, Tri-Dim, Filtration Group, Camfil-Farr

2.2 MEDIUM EFFICIENCY AIR FILTERS (MERV 8 PLEATED TYPE)

A. The filter shall have a Minimum Efficiency Reporting Value of MERV 8 and a minimum arrestance of 95% A when evaluated under the guidelines of ASHRAE Standard 52.2-2007. It shall also have a MERV A of 8-A when tested per Appendix J of the same standard. The media shall maintain or increase in efficiency over the life of the filter. The filter shall be classified by Underwriters Laboratories as UL Class 2.

B. Filter media shall be a polyester/cotton blend or 100% synthetic blend, mechanical media which does not support microbial growth, lofted to a uniform depth of 0.18 in., and formed into uniform radial pleats. There shall be at least 15 pleats per linear foot for the 2 in. deep filter. A welded wire grid, spot-welded on one-inch centers, treated for corrosion resistance, shall be bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation.

C. Frame shall be heavy duty, high strength, moisture resistant paperboard with a cross member design that increases filter rigidity and prevents breaching.
Frame shall be made with 100% recycled paperboard with an average of 35% post-consumer content. Frame shall be recyclable.

D. The enclosing frame, of no less than 28 point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media to prevent air bypass, and include integral diagonal support members on the air entering and air existing side to maintain uniform pleat spacing in varying airflows.

E. For the 2 in. filter, initial resistance to airflow shall not exceed 0.31 in. w.g. at an airflow of 500 fpm.

F. Filter shall have a recommended maximum final resistance of 1.0" w.g.

2.3 HIGH EFFICIENCY FILTERS (RIGID POCKET OR V-CELL TYPE)

A. The filter media shall be 100% synthetic and manufactured from three distinct layers. The prefilter layer shall be a spun bond polyester. The middle layer shall be constructed from electrostatically spun polycarbonate microfibers. The downstream layer shall be a spunbond. Filters containing either urea-extended phenol formaldehyde binders, wet-laid microfiberglass, or polypropylene microfibers are not acceptable.

B. The filter media shall be resistant to mechanical damage caused by handling.

C. The filter media packs shall be sealed to plastic end caps with hot glue to ensure leak-proof seal.

D. Frame shall be high-impact plastic and contain no metal parts.

E. The filter media shall be hydrophobic and the filter shall operate unaffected at relative humidity up to 100%.

F. Filter shall incorporate 1" offset to improve air intake performance. Filter shall be available in 12.5" depth.

G. The filter shall be UL classified as to flammability, Class 2.

H. The filter shall have a Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of ASHRAE Standard 52.2-2007. It shall also have a MERV A of 13-A when tested per Appendix J of the same standard. The media shall maintain or increase in efficiency over the life of the filter. The filter shall be classified by Underwriters Laboratories as UL Class 2.

I. Initial resistance to airflow shall not exceed 0.22" w.g at an airflow of 500 fpm. Filter shall have a recommended maximum final resistance of 1.5" w.g.

J. Filter shall have a documented wet burst strength of no less than 15" w.g.

2.4 MAGNEHELIC GAUGE

A. 3-7/8 in. diameter white dial diaphragm actuated air filter gauge. Guaranteed accurate to ± 2% of full scale. Pointer zero adjustment. Provide all accessories including adapters, mounting panel, pressure tips, fittings, tubing, and vent valves.

B. Range:

1. Pre-filters; 0-1" wc, Dwyer Model 2001

2. Final filters; 0-2" wc, Dwyer Model 2002

C. Design Equipment: Dwyer Magnehelic Series 2000 with air filter gage accessory package.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide one set of spare filters of each type for each system requiring a filter. Install first set of filters when units are initially installed (as opposed to started).

B. Change filters as required during construction period to maintain systems in a clean manner throughout the construction period. Remove dirty set and install one clean set prior to Owner occupancy. If original filters do not require replacement, as determined by Owner's Representative, then deliver final set to Owner and obtain receipt.

3.2 MAGNEHELIC GAUGES

A. Provide for each filter set. Provide separate gauge across pre-filter and final filter assemblies.

END OF SECTION

HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plate and frame heat exchangers.

1.2 DEFINITIONS

A. TEMA: Tubular Exchanger Manufacturers Association.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Tube-removal space.

2. Structural members to which heat exchangers will be attached.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

B. Failures include, but are not limited to, the following:

1. Structural failures including heat exchanger, storage tank, and supports.

2. Deterioration of metals, metal finishes, and other materials beyond normal use.

C. Warranty Periods: From Date of Substantial Completion.

1. Plate Heat Exchangers:

a. Plate-and-Frame Type: One (1) year.

PART 2 - PRODUCTS

2.1 PLATE AND FRAME HEAT EXCHANGERS

A. Acceptable Manufacturers:

1. Basis of Design Product; Subject to compliance with these requirements to provide. Bell & Gossett heat exchanger(s) or compatible product as manufactured by:

a. Sondex
b. Alfa-Laval

B. Provide plate and frame heat exchanger with individually removable 0.4 mm, 316 stainless steel or titanium plates with epoxy coated steel frame aluminum OSHA shroud, nitrile "presstite" glueless gaskets, nylon roller assembly.

1. General:

a. Unit shall be single pass unless otherwise specified.

b. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

c. Construction: Fabricate and label heat exchangers to comply with ASME Boiler Pressure Vessel Code, Section VIII, "Pressure Vessels", Division 01.

d. For single pass units, all connections shall be located on the fixed head, frame plate allowing the movable head, pressure late, to slide back and plates added, removed, or replaced from the plate pack without disturbing.

e. The design shall allow for the removal of interior plates without the removal of the preceding plates.

f. Unit(s) within the scope of AHRI Standard 400 shall be certified and list the manufacturer's AHRI part number for liquid to liquid heat exchanger. Unit(s) outside the scope of AHRI Standard 400 shall be designed according to the standard and list the manufacturer's AHRI part number, surface area, and corresponding heat transfer coefficient.

2. Frame:

a. The frame plate and pressure plate shall be carbon steel SA 516 Grade 70.

b. The frame and pressure plate shall be of sufficient thickness to meet the ASME design pressure. Stiffeners to support brackets are not acceptable.

c. Carbon steel frame components shall be painted with epoxy paint.

d. Units with 3 in. or greater connections shall be unlined or alloy lined studded ports to mate with raised face or flat faced ANSI flanges. Rubber liners are not acceptable.

e. Units with 2 in. or 2-1/2 in. connections shall have carbon steel female tapped NPT or male NPT connections if an alloy material is required.

f. Units with 1 in. ports shall have carbon steel or 316 stainless steel female tapped NPT or male NPT connections if an alloy material is required.

g. Units with connections greater than 2 in. require that the thermal plates be supported by the carry bar, top bar. The guide bar, bottom bar, shall only help properly align the plates.

h. The carry and guide bar plate contact surfaces shall be stainless steel.

i. Units with 2 in. connections or smaller shall allow the plates to be supported by the guide bar, bottom bar and the carry bar, top bar, to properly align the plates. Carry and guide bars shall be steel with a zinc chromate coating.

j. Provide a protective shroud to cover the exposed top and sides of the plate pack. The shroud shall include handles to provide quicker and safer removal during maintenance. The shroud shall be aluminum or stainless steel as required.

3. Tightening Bolts:

a. Tightening bolts shall be zinc plated carbon steel SA193 B7.

b. The tightening bolt assemblies shall include captive working nuts at the pressure plate, rear head, such that the unit can be opened and closed with one wrench from the front of the unit.

c. Thrust bushings (ball bearing box washers) shall be located at all critical closing bolts on plate heat exchangers with 10 in. connections or greater. The thrust bushings shall allow for easy opening and closing of the plate heat exchanger without damaging the epoxy coating of the follower (fixed pressure plate).

4. Plates:

a. Plates shall be pressed in a one-step stamping process.

b. Plates shall use an integral rolled edge handing system to provide a rigid hanger device between the plate and carry bar and guide bar. Welded on hanging brackets or stiffeners are not acceptable.

c. The plate pack shall use a positive plate to plate alignment system to ensure proper plate to gasket seals throughout the plate pack.

The positive alignment system shall either be a gasket lug which fits within a plate recess on the proceeding plate (tongue in groove) to align successive plates or an extended rolled edge hanger which nests successive plates through direct contact around the entire plate hanger. Plate designs, which only offer alignment through contact with the carry and guide bar, are unacceptable.

d. Plates shall be permanently marked to indicate plate materials and thickness.

5. Gaskets:

a. All gaskets except the gasket on the first plate shall be identical.

b. The gaskets shall be a one-piece construction with a double gasket barrier at the port region. The area isolated by the double gasket shall be vented to the atmosphere, so that a gasket failure is detected by leakage to the exterior prior to any possible cross contamination. Gaskets shall include color coded tabs that protrude past the perimeter of the heat transfer plate in order to allow positive identification of the gasket material without opening the heat exchanger.

c. When available, glue free gaskets are preferred to glued-on gaskets. Gasket attachment methods, which break during gasket removal or plate maintenance, thus destroying the gasket is not acceptable.

C. Unit shall be ASME 'U' rated to 150 psi at 284°F.

D. Unit shall be UL listed.

E. Heat transfer performance as listed in schedule.

F. Heat exchanger shall be constructed as required by ASME and shall permanently display and ASME 'U' stamp.

2.2 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel supports for mounting on floor.

2. Factory fabricated steel supports to ensure both horizontal and vertical support of heat exchanger.

B. Heat Exchanger Insulated Shroud:

1. Provide OSHA compliant modular insulation package consisting of inner and outer panel covering all sides, top and bottom including frame and pressure plate.

2. Shroud shall be constructed of an inner aluminum liner, 2 in. thick polyisocyanurate foam board insulation and an outer embossed aluminum panel.

3. Insulation panels shall site in a 24 gauge galvanized steel drip tray with valved drain line.

4. Modular design shall incorporate stainless steel spring tension loop above latches that provide a tight seal for rubber type compressed between the latches.

5. Insulation shroud shall be removable and reversible.

6. Service temperatures shall be -100°F to 250°F.

7. Panel insulation shall meet flammability ratings under ASTM E84, E119 and UL 723, 1040 and 1715.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PLATE HEAT-EXCHANGER INSTALLATION

A. Equipment Mounting: Install heat exchangers on cast-in-place concrete equipment base(s).

1. Constructed bases to withstand, without damage to equipment, seismic force required by code.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 in. centers around the full perimeter of concrete base.

3. For supported equipment, install epoxy coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3.3 CONNECTIONS

A. Maintain manufacturers recommended clearances for service and maintenance.

B. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

3.4 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION

AIR HANDLING UNITS – CUSTOM

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, equipment, testing and services to perform all operations required for the complete installation as shown on the Contract Documents.

1.2 SUBMITTALS

A. Submit shop drawings on air handling units. Submittal shall include all dimensional drawings with associated weights and breakdown details pertaining to shipping and rigging. Include all materials of construction as well as fabrication and connection details. Include roofing type and color information for outdoor units.

B. Shop drawing to include plans and elevation detailing exact location of all components, access door locations with indicated swing direction, duct and piping connection sizes, shipping split locations and maintenance access clearance dimensions.

C. Provide detailed performance of all components for comparison to all scheduled values including but not limited to following: Fan manufacturer and performance curves with operating points clearly indicated. All motor size and type information. Coil selections with sizing, rows, fin spacing, face velocity, air and fluid temperatures, flow rates, pressure drops and connection sizes. Heat recovery components with performance characteristics. Filter type, sizing, efficiency and pressure drop.

D. Provide complete electrical data information including wiring diagrams and accessories. Clearly indicate differentiation between factory and field wiring.

E. Provide octave band sound power levels for intake, supply and return air connections as well as radiated sound levels from enclosure.

F. Provide all factory testing data with associated testing procedures.

G. Test results showing AHU foam casing panel construction is in compliance with the fire and smoke spread requirements of Building Code of New York State and Mechanical Code of New York State.

H. Operation and maintenance manuals. Include list of all required service procedures and intervals. Include list of required replacement parts for maintenance.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 230513 - Motors

B. Section 230550 - Wind Restraint for HVAC Systems

C. Section 230593 - Testing, Adjusting and Balancing

D. Section 230923 – Building Management System

E. Section 234100 - Air Filters and Accessories

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. NFPA 70 National Electrical Code

2. Coil performance shall be rated in accordance with AHRI Standard 410 and bear the AHRI seal.

3. Fan shall be tested to AMCA Standards as follows: AMCA 208 for fan energy index, AMCA 210 for performance AMCA 330 for sound. The fan shall be licensed to bear the AMCA Certified Ratings Program Seal as follows: AMCA 208 for fan energy index, AMCA 211 for performance AMCA 311 for sound.

4. The AHU foam panel construction shall be in compliance with and built to meet the fire and smoke spread requirements of Building Code of New York State and Mechanical Code of New York State.

5. Heat Pipe performance data derived from laboratory testing on heat exchanger conditions shall be in accordance AHRI Standard 1060-01 by a qualified independent testing laboratory.

6. Equipment within unit shall be UL listed where applicable.

1.5 DELIVERY, STORAGE AND HANDLING

1. Air handling unit(s) shall be shipped to the site in assembled sections based on shipping splits suitable for rigging at the site. Size of each piece shall be no greater than required for trucking or rigging (Refer to plans for more detail). The equipment supplier shall provide factory authorized supervision to guide and assist in the joining and assembly of the air handling unit sections in the field. The unit manufacturer shall coordinate with other trade contractors, all necessary requirements to ensure proper air handling unit installation.

2. The Contractor shall prepare the site, including, but not limited to removal of existing equipment, ductwork, ductwork accessories, piping, piping accessories, controls, roof flashing coordination and preparation, and construction and leveling of steel support framing before factory supervised assembly the air handling unit. Steel support framing is to be installed to tolerance of level and flatness required by unit manufacturer. Pads and/or supports are to be laser leveled.

B. When scheduling does not allow delivery directly to the job site for unforeseen complications then an indoor weather tight secure storage facility must be utilized and is not considered as delivery. All unit openings and components must remain sealed to prevent any entrance of dust or dirt.

C. The units must be rigged and lifted in strict accordance with the manufacturer's recommendations.

1.6 MANUFACTURER AND EQUIPMENT SUPPLIER'S GENERAL BIDDING REQUIREMENTS

A. It is the intent of these specifications and referenced specification sections to provide the minimum design and performance parameters without being proprietary toward a specific equipment supplier. It is the responsibility of the listed acceptable equipment suppliers to meet the basic intent of the specifications and drawings. The overall "box" size of Air Handling Units as shown on Drawings shall not be deviated from. It is not the option of the equipment supplier to increase or decrease the physical size of the equipment without engineer approval. In addition, the configuration or layout of the individual components within the unit cannot be modified or changed without qualified explanation and approval of engineer. Any deviations shall be clearly identified on submittal. Final dimensioning of unit casing and openings shall be part of coordination drawing process performed by contractor prior to ordering of equipment.

B. Manufacturer and contractor are also responsible for coordinating conduit and devices internal to the unit which require mechanical connection to the unit casing. This includes all lighting circuits, power from fan motors to junction boxes on exterior of unit, all damper actuators, sensors, airflow stations, safeties, and limits as specified and shown on Control Schematic Drawings and Electrical Drawings. Controls sub-contractor shall submit a CAD drawing to unit manufacturer for coordination process showing locations in each AHU where required sensors need to be placed as well as required wiring from devices to a common location in unit where control cabinet will be placed. Panel mounting rails shall be provided by unit manufacturer based on system coordination. Controls wiring and device installation to be coordinated for field installation provided that all internal conduit runs and/or mounting brackets are factory installed so no unit penetrations or connections are made by controls field personnel affecting integrity of unit casing. Ductwork, service piping, electrical utilities connections and Controls connections to be made in field by contractor.

C. The units shall be constructed for outdoor installation. The unit construction shall be factory designed, fabricated/built, and assembled. The equipment supplier shall be completely responsible for the unit assembly as well as arranging/performing the onsite verification testing specified.

D. The equipment supplier and unit manufacturer shall include in their bid price the cost associated with all field performance testing as specified including the cost associated with hiring a certified Testing and Balancing Contractor to conduct all field performance testing.

1.7 WARRANTY

A. Except otherwise specified, the manufacturer shall include a warranty and shall guarantee all work against defects in materials, equipment, and workmanships for a period of (1) year from the date of acceptance of the work as evidence by a resolution to the effect by the owner and for that period of time noted in special or extended warranties.

B. The manufacturer shall provide a Corrosion warranty for the unit cabinet against general corrosion in the cabinet walls, floors, roof, doors, and fastening hardware.

1.8 TRAINING

A. The air handling unit manufacturer shall provide a minimum of 4 hours of training.

1.9 FACTORY AUTHORIZED START-UP AND FACTORY JOINING SERVICE

A. The air handling unit manufacturer shall provide a minimum of 16 hours of factory start-up and assembly joining service.

1.10 FACTORY PERFORMANCE TESTING

A. General Requirements:

1. Factory testing shall assure the Owner and Engineer that any potential system performance concerns are addressed in the factory before unit shipment. Any unit modifications necessary because of factory testing not meeting specified performance levels shall be done by the unit manufacturer at no additional cost to the owner prior to unit shipment.

2. A formal written report including all test procedures and accepted results shall be submitted to the Engineer.

B. Casing Leakage Test: The assembled air handling unit shall be factory leak tested to verify that unit casing leakage is less than 1/2% of design air flow at 1-1/2 times the design static pressure. A casing leakage test shall be performed in the field after unit is fully assembled in place with all penetrations in place and properly sealed. The unit shall be sealed with blank off plates over all duct connections, all coil header penetrations to have sealing grommets installed and all conduit and controls openings shall be sealed. Positive pressure sections shall be put under positive pressure. Negative sections shall be put under negative pressure. The leakage shall be measured in each section using a calibrated orifice plate. The total casing leakage (positive plus negative) shall be considered the total sum of the positive and negative leakage not to exceed the 1/2% limit.

C. Performance Testing: The assembled air handling unit shall be factory tested to demonstrate the actual performance matches the scheduled unit performance by testing and operating the unit at design conditions; simulating external static pressure (providing for dirty filters and wet coils). Test shall include measurements of CFM, BHP and RPM at design TSP. The unit design cfm and static pressure shall be delivered at a brake horsepower within 2% of design conditions.

D. Casing Deflection Testing: The assembled air handling unit shall be factory tested to verify the unit casing maximum panel deflection is 1/200 of the panel span at the 1-1/2 times the design positive or negative unit static pressure.

1.11 FIELD PERFORMANCE TESTING

A. General Requirements:

1. The unit manufacturer and equipment supplier shall be responsible for conducting all specified field tests and coordinating with installing contractor. The unit manufacturer shall provide testing equipment and instrumentation as needed for testing. Field testing shall assure the Owner and Engineer compliance with this specification after the unit is fully assembled in place.

2. A formal written report including all test procedures and accepted results shall be submitted to the Engineer. All reports by the Testing and Balancing Contractor shall comply with the format and the parameters to be tested shall be as per the requirements of specification Section 230593.

3. Should the unit fail first performance test, the manufacturer will have an opportunity to make corrections at no cost to the Owner. Any additional cost incurred for additional testing, performance documentation, etc. shall be covered by the contractor. The corrections shall long term permanent solutions in line with unit construction details and not inhibit the normal use of access doors and service panels.

4. In the event the manufacturer cannot achieve/pass required performance and leakage test the owner shall reserve the right to a rejection of equipment acceptance for failed performance, seek financial compensation from the manufacturer commensurate with the Owner's anticipated increased operating costs or require further modifications made and the unit be tested again. Failure to pass the final leakage test will subject the air handling manufacturer to penalties based upon the total energy cost for the additional leakage over 1/2% for a minimum operating period of ten years, or up to 5% of the air handling unit cost.

B. Casing Leakage Test: The testing and balancing contractor, hired by the unit manufacturer, shall perform and provide documentation for the casing leakage test. The testing shall verify that unit casing leakage is less than 1/2% of design air flow at 1-1/2 times the design static pressure. A casing leakage test shall be performed in the field after unit is fully assembled in place with all penetrations in place and properly sealed. The unit shall be sealed with blank off plates over all duct connections, all coil header penetrations to have sealing grommets installed and all conduit and controls openings shall be sealed. Positive pressure sections shall be put under positive pressure. Negative sections shall be put under negative pressure.
The leakage shall be measured in each section using a calibrated orifice plate. The total casing leakage (positive plus negative) shall be considered the total sum of the positive and negative leakage not to exceed the 1/2% limit. The testing shall be witnessed by the Owner representatives, the Commissioning Agent and the Engineer of Record.

C. Coil Pressure Testing: Pressure test all coils. Water coil shall be tested at 225 psi air pressure under water and suitable for use at working pressures up to 150 psi.

D. Vibration Testing: The assembled air handling unit fan(s) and motor(s) shall be tested at the specified fan RPM in accordance with AMCA 204. Vibration signatures shall be taken on each fan and motor bearing in the horizontal, vertical, and axial directions. The maximum allowable fan vibration level shall be in accordance with Fan Application Category BV-3.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CUSTOM BUILT UP AIR HANDLING UNITS

A. Provide air handling unit to fit intended use and in locations called for. Provide fan sections, filter sections, mixing box, plenums, coil sections, heat recovery components, damper configurations and other sections as called for and shown on the detail drawing. Maintain draw-thru configuration as indicated in plans. Capacity, size arrangement, static pressure, brake horsepower, component parts and accessories as called for and as necessary to obtain required results and allow for proper maintenance.
Guaranteed full capacity delivery through duct systems finally installed and under conditions listed. Guaranteed sound power level ratings not exceeding those of design equipment, or as scheduled. Quantity and arrangement of fans and unit components to be consistent with design unit as indicated on detail drawing and mechanical room drawing documents.

B. Gauges of metal and construction to be heavy enough to prevent vibration, undue noise or breathing. Unit design based on all galvanized steel construction.

C. Coordinate all rigging requirements, coil pulls, maintenance access, drain trap heights, drain locations and ductwork connections prior to ordering unit.

D. Airflow inlet and outlet opening limited to a maximum velocity of 1500 fpm unless specifically noted otherwise on design detail drawing.

E. Fan classification as designated by Unit Manufacturer based on minimum requirement listed below:

Maximum Total S.P.	CLASS
Up to 3 3/4 in. WG-STD	I
Up to 6-3/4 in. WG-STD	II
Up to 12-3/4 in. WG-STD	III

F. Vibration levels shall be factory tested for VAV applications. Special balancing and structural components shall be provided to minimize harmonic vibrations.

G. Pressure drop across the filter bank shall be minimum 1.5 in. w.g. and shall be included into the internal static pressure losses of the equipment.

H. Structural Design Criteria: All wall panels, roof panels and internal component attachments to be fully supported by structural framing members integral to unit construction. Support from formed skins or panels as structural element alone is not acceptable. All fan/motor lift points and beams to be supported from floor base.

I. Outdoor / roof mounted units shall also comply with the following criteria:

1. The roof mounted HVAC enclosure shall be designed to resist the New York State Uniform Fire Prevention and Building Code mandated loads except as modified below.

2. The HVAC enclosure manufacturer shall assume a snow load of 32 psf.

3. The HVAC enclosure manufacturer shall design the enclosure for wind forces conforming to the "Minimum Design Loads for Buildings and other Structures", ACE 7-88 (formerly ANSI A58.1) criteria for basic wind speed of 75 mph. This design shall account for windward, leeward, and corner pressures on the enclosure walls, roof uplift and downward pressures caused by the attached sloped roof and other lateral forces in the design of the enclosure.

4. The manufacturer is responsible for the design and supply of all connections of the enclosure to the building's structural frame. Other connection shown on drawings will be provided by the manufacturer in addition to those required by the manufacture's design.

5. The enclosure manufacturer shall provide certification that the enclosure was designed by a licensed professional engineer and conforms to all requirements listed here and in *Section 230550, Wind Restraint for HVAC Systems*.

6. Provide wind restraint in accordance with specified requirements.

J. Manufacturer shall refer to Mechanical Drawings for the air handling unit detail drawings with additional details and requirements. Refer to Mechanical Drawings for the air handling unit Controls Schematic Drawing for additional device and conduit requirements. Refer to plan view drawing(s) for coordination and rigging relationship.

K. Maximum total unit weight as shown on custom air handling unit drawing is estimated unit weight not to exceed 23,500 lbs total per unit.

L. Design Equipment: Semco

M. Acceptable Makes: Temtrol, TMI, York Custom, Ventrol

1. Cornell University Facility Engineering to advise on three to five preferred acceptable makes to include in the spec. Buffalo Air Handling typically no longer bids galvanized units.

2.2 UNIT CASING

A. Double wall, insulated, air pressure tight, casing assemblies. Galvanized stee panels with galvanized steel framing members.

All parts shall be galvanized steel, including unit blank-offs and safing, unless otherwise indicated elsewhere in this specification. Where dissimilar metals are used they shall be dielectrically isolated to prevent galvanic action. Bolts and hardware shall be stainless steel.

B. Panels minimum 2 in. thick with minimum 16 gauge thick exterior sheet and 16 gauge thick interior sheet. Interior finish to be smooth, mill finish; exterior finish to be textured/embossed mill finish. All sections shall have solid interior liner unless specifically noted otherwise. Provide perforated interior sheets on supply discharge plenum and fan sections. Wall panels shall be continuously sealed (gasketed) between interior and exterior skin. Panels shall be unitized in such a manner as not to disturb the insulation if panels are removed. Spot welding or mechanical fasteners shall be on 6 in. centers maximum.

C. Panel system and access doors shall include thermal breaks such that there is no through metal path between the inner and outer panels, as well as between the walls and structure. Adhesive tapes or gaskets will not constitute an acceptable thermal brake. Thermal brake and panel insulating coefficient shall be designed to guarantee that casing will not sweat with ambient casing conditions of 91F DB / 74F WB and interior conditions of 51F or scheduled unit performance, whichever is greater.

D. Interior panel space packed with closed-cell foam. Panel U-value shall not exceed 0.0588 BTU/hr./sq.ft/°F (R-17 minimum) based on 2 in. minimum panel thickness. The insulation shall meet the smoke and flame requirements of the Building Code of New York State and Mechanical Code of New York State and the erosion requirement of UL 181 facing the air stream.

E. Access doors for service access between each section, for replacing filters and access to dampers as shown on the detail drawing. Door swing to be based on pressure differential direction of flow so that doors are pushed closed and not open when unlatched under operating pressures.

F. Door panels constructed of same material and gauges as AHU casing panels; minimum door size of 24 in., unless otherwise indicated on drawings, 2-1/2 in. minimum thickness of the overlapping seal type. Doors shall be supplied with two, continuous non-pinching neoprene gaskets and stainless steel piano hinges. Minimum of two non-corrosive latches with an inside release handle. Doors shall be assembled with hinge hardware attached and adjusted in the field. Door latches wedge lever type with handles inside and outside. Hinges designed for door size and weight. Doors installed to open against the air pressure. Interior doors shall have 10 in. minimum square thermal pane windows at 60 in. above bottom of unit base rail. All doors serving fan sections or other rotating equipment shall be provided with lockable type hardware. A door entering into rotating components of the air handling unit shall be provided with signage indicating “Do Not Enter – Rotating Machinery”. Provide 1 in. diameter test ports with screwed caps on access doors upstream and downstream of filters and coils for pressure and temperature measurement.

G. Roof channels, aprons and corners joined of galvanized steel and formed to prevent a direct path for sound and/or air leakage. Panel joiners 24 gauge minimum. Where these roll formed joiner sections are not utilized, 16 gauge minimum.

Panel joiners and connectors shall allow for expansion.

H. Air and watertight sleeves, caulked and insulated where pipes and conduits penetrate unit casings.

I. The structure shall be fully self-supporting. Where roof spans and wall loadings require additional structural strength, it shall be furnished either by heavier roof and wall joiners, or, additional structural members capable of withstanding a differential pressure of 10 in. w.g.

J. Provide plug panels for removal of fans, motors, heat recovery components and coils. Split panels where removal of a single coil is through connection side.

K. Any equipment flashing, internal partitions or other attachments to the casing shall be made in such a way as to ensure a permanent leak tight connection. Attachments that are bolted, screwed, or welded to or through the casing creating air bypass, air leakage or rust propagation area are not acceptable.

L. Multiple section units shall be bolted together in the field using 304 stainless steel bolts, nuts and washers.

2.3 UNIT BASE

A. Units to shall be constructed on structural 8 gauge galvanized steel, full perimeter base channel of sufficient depth for proper unit support and condensate trap, 6 in minimum. The base shall be designed to distribute loads properly to a suitable mounting surface and be braced to support internal components without sagging, pulsating or oil canning.

B. The underside side of the base pan and base perimeter shall be insulated with minimum 2 in. thick closed foam insulation to form a vapor barrier. Base insulation U-value shall not exceed 0.0588 BTU/hr./sq.ft/°F (R-17 minimum). Vapor barrier is then protected by a 18 gauge galvanized steel sheet skin. Skin to be recessed inside of unit base to prevent rigging damage. Skins fastened to bottom of unit support rails are not acceptable.

C. Provide individual drains in each section of the air handling unit with piping extended to unit exterior base and capped. All sections or compartments of the unit shall be fully drainable.

D. The base assembly shall have a minimum of four lifting lugs per shipped section.

E. All equipment within the air handling unit shall be provided with a minimum 2 in. high welded base rail to raise equipment off the unit floor for housekeeping. Equipment mounted directly to the floor with fastener or drilled holes penetrating the water seal base is unacceptable.

F. Fastening to floor plate or joining of unit sections to be accomplished by bolting through gasketed joints above the floor line or continuously welding. Fasteners which penetrate base floor plate are not acceptable.

G. Floor Construction:

1. The floor in all air handling sections shall be minimum 10 gauge galvanized steel safety tread plate welded at all joints and to structural members. The floor of all sections with drain pans, cooling coil and heat recovery coils, to be constructed with a minimum of smooth 18 gauge, 304 stainless steel in lieu of galvanized steel. The floor plate thickness and supports shall be sufficient to avoid any "tin canning" when 200 lb. point loading is applied to the flooring system and a minimum live load of 100 lb. per square foot throughout the unit. Caulking, gaskets and mechanical fasteners to guarantee seals and water tightness of joints will not be acceptable.

2. All unit base service openings shall be framed with a minimum 2 in. high water dam continuously welded to the floor. All pipe and electric conduit chases with openings to building or elements shall be covered with thin gage 304 stainless steel. Penetrations by contractors shall be sealed by the respective contractor.

2.4 UNIT ROOF SYSTEM

A. Outdoor units shall incorporate a sloped roof with 1/4 in. per foot slope. For units exceeding 12 ft in width the roof shall be peaked in center and sloped to both sides. Units under 12 ft wide are to be peaked at door side and continuously sloped to non-door side. All roof joints shall have turned up and capped flanges. Roof to be covered with 1 in. minimum thickness rigid board insulation and roofing membrane. Insulation may be tapered to achieve required roof slope. Unit shall be provided with a non-corrosive rain gutter system with downspouts to guide unit roof water run-off to the building roof.

2.5 VESTIBULE / SERVICE CORRIDOR

A. Provide mounting brackets for all electrical panels, control panel enclosures and adjustable speed drives in service corridor as indicated on detail drawing. All locations to be coordinated with installing contractors of various trades.

B. Provide structural support bracing in service corridor ceiling to support hanging of unit heater, pipes and conduits without connecting to any surfaces of unit.

2.6 FAN SECTION

A. Provide fans, motors and drives of number, size and capacity as required for air handling system indicated on drawings and as stated in these specifications.

B. Plenum Type Fan: All fan sections shall be complete with SWSI, arrangement 4 (direct drive); Belt driven fans are not acceptable:

1. All fans shall be constructed to meet the AMCA Standards for Sound, Air Performance and Fan Energy Index. Fan shaft shall be solid 1040 or 1045 hot rolled steel that is turned, ground and polished.

2. The blades shall be aluminum airfoil design and shall be continuously welded to the wheel shroud and backplate. The fan shall be mounted in the horizontal position.

3. The frame shall be constructed of heavy structural steel members, continuously welded.

4. All equipment shall be statically and dynamically balanced to grade G6.3 per ANSI S2.19 tolerances with weights permanently fastened to fan blades, and components including the motor, installed on unit. Fan bearings greaseable with extended lubrication lines shall be rated for L-50 life at 200,000 hours minimum.

C. Motors: Provided by equipment manufacturer and conforming to all requirements of specification Section 230513. Horsepower and type as called for from acceptable manufacturers listed. When VAV drives are used, the motors provided shall be matched to the adjustable speed drive selected for use. Motor to be suitable for use as a direct drive application and to be matched to fan to meet performance requirements. Provide with shaft grounding system.

D. Vibration Isolation:

1. Provide vibration isolation equipment for each fan supplied inside the air handling unit enclosures.

2. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall not be less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 60% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of neoprene. Each isolator shall be mounted on a 1/4 in. thick neoprene friction pad. A rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. Grommets shall be provided for each bolt hole in the bearing plate. Minimum static deflection shall be 2.0 in.

3. Plenum fans shall be provided with spring thrust restraints.

4. Flexible connector: woven nylon/polyester blend with vinyl coating. Minimum fabric weight - 22 oz./sq. yd. Material to meeting UL 181 as Class 0, Class 1 Material.

5. Make: Mason Industries, Inc., Vibration Mountings and Controls, Inc., Kinetics Noise Controls, Inc.

E. Accessories:

1. Provide overhead beam with trolley for removal of fan motor. Align with motor and access panel/door. Arrangement to allow for removal of fan motor and components through casing into mechanical room.

2. Provide all fans with Piezometer rings installed in fan inlet. Airflow transmitter shall be provided by the Controls sub-contractor.

3. Provide guards meeting OSHA standards at fan inlet and to completely enclose fan wheel and rotating parts. Provide flexible connection between fan inlet and inlet wall. Provide dampened thrust restraints.

4. Unit with parallel fans to include fan isolation dampers for independent operation of parallel fans in event of a fan failure.

5. Units to be provided with removable panels in casing to allow for fan removal. Panels shall be located on both sides of the air handling unit. These panels shall be gasketed, effectively sealed without other sealants or caulks, and shall be secured with stainless steel machine screws or other reusable fasters. Self-tapping screws are not acceptable.

F. Design Equipment: Twin City.

G. Acceptable Makes: Aerovent, Cook, Greenheck, New York Blower, Twin City.

2.7 COIL SECTIONS

A. General Requirements:

1. Coils shall be designed for 125 psi working pressure, counterflow heat transfer, bottom supply and shall be designed to relieve expansion and contractions strains. Provide coils of proper size and rows to fit intended use and capacity as scheduled or as required to meet performance specifications. Non-trapping circuit; circuited so as to keep head loss through coil not greater than called for. Provide with turbulators, where required to achieve scheduled performance. Air and water pressure drops not to exceed scheduled values.

2. Fins: Construct of continuous, minimum 0.0075 in. thick, aluminum fins, plate type with expanded tube and full fin collars for accurate spacing and maximum fin-tube contact. Fin spacing shall not exceed 12 fins per inch (FPI).

3. Casings: Construct of 16 gauge, 304 stainless steel for coil heights 33 in. and smaller; 14 gauge, 304 stainless steel for coil heights over 33 in. Provide formed ends supports and top and bottom channels. Provide 16 gauge stainless steel center support for coil lengths 42 in. to 96 in.; two or more supports for coil lengths over 96 in.

4. Tubes: Construct of minimum 5/8 in. diameter seamless copper with not less than 0.035 in. tube wall, expanded into fin collar for permanent fin-tube bond and expanded into header for permanent leak-tight joint. Tubes shall be arranged into staggered pattern with respect to airflow.

5. Connections: Same end connections. Grooved connections NOT acceptable.

6. U-Bends: Construct of minimum 0.035 in. thick copper tubes, machine die formed on each end to provide an accurate fit for silver brazed joints.

7. Air Bypass Barrier: Frame and blank-off spacers between coil and frame housing shall be stainless steel with foam seal. Use stainless steel hardware to fasten blank-offs and frames.

8. Non-ferrous headers and connection.

9. Coils to be individually supported by a stainless steel rack system. The rack shall allow any one (1) coil to be removed through the unit casing without disturbing any other coil.

10. Vent and drain connections shall be provided at the top of bottom of each header and shall be no less than 1/2 in. NPT.

11. Units to be provided with removable panels in casing to allow for coil removal. Panels shall be located on both sides of the air handling unit. These panels shall be gasketed, effectively sealed without other sealants or caulks, and shall be secured with stainless steel machine screws or other reusable fasters. Self-tapping screws are not acceptable.

12. Acceptable Makes: Heatcraft, Aerofin or Coilmaster.

B. Hot Water / Glycol Heating Coil Sections:

1. Coils shall be selected with a maximum face velocity of 550 FPM.

C. Chilled Water Cooling Coil Section:

1. Coils shall be selected with a maximum face velocity of 450 fpm. Unit manufacturer shall assure no moisture carryover from coils at design conditions.

2. Double, pitched type 304 stainless steel drip pan(s), minimum of 18 gauge, shall extend the entire width of the coil section a minimum of 18 in. downstream from the coil discharge. Each coil in a multiple stack coil arrangement shall be provided with its own intermediate drain pan. The intermediate drain pan shall be double, pitched type 304 stainless steel drip pan(s), minimum of 18 gauge, shall extend the entire width of the coil section a minimum of 12 in. downstream from the coil discharge with a copper or stainless steel down spot at the lowest point to allow for proper drainage to the bottom drain pan. Drain pans recessed into the floor shall be insulated. Each drain pan shall have its condensate piped through the unit wall with sealing grommets. Each coil shall be caulked and flashed in place to prevent carryover of condensate.

2.8 HEAT PIPE ENERGY RECOVERY SECTION

A. Furnish and install the heat recovery units of the heat pipe air-to-air type, as shown in the schedule.

B. Heat recovery units shall transfer heat between outgoing and incoming air streams in counter flow arrangement.

C. Heat recovery units shall be labeled for direction of air flow, exhausts inlets and outlets and supply inlets and outlets.

D. Horizontal rack system with refrigerant filled 1/2 in. copper tubes with aluminum fins.

E. Air Bypass Barrier: Frame and blank-off spacers between coil and frame housing shall be stainless steel with foam seal. Use stainless steel hardware to fasten blank-offs and frames.

F. Casings: Construct of 16 gauge, 304 stainless steel for coil heights 33 in. and smaller; 14 gauge, 304 stainless steel for coil heights over 33 in. Provide formed ends supports and top and bottom channels. Provide 16 gauge stainless steel center support for coil lengths 42 in. to 96 in.; two or more supports for coil lengths over 96 in.

G. Coils to be individually supported by a stainless steel rack system. The rack shall allow any one (1) coil to be removed through the unit casing without disturbing any other coil.

H. Refrigerant: R513a.

I. Fixed assembly with air tight seal between supply air stream and exhaust system with a foam filled double serpentine partition.

J. Pre-filter face and bypass damper on both air streams.

K. Counter flow design. A partition shall be provided to isolate the outgoing and incoming air streams; there shall be no cross contamination. The partition shall be located in the center of the heat pipe unless otherwise specified.

L. Double, pitched type 304 stainless steel drip pan(s), minimum of 18 gauge, shall extend the entire width of the coil section a minimum of 18 in. downstream from the coil discharge. Drain pans recessed into the floor shall be insulated. Each drain pan shall have its condensate piped through the unit wall with sealing grommets. Each coil shall be caulked and flashed in place to prevent carryover of condensate.

M. Exhaust side of heat pipe shall have a protective coating of Electrofin E-Coat for corrosion resistance.

N. 5 year limited warranty on parts and labor.

O. Design Equipment: ACT AAHX

P. Acceptable Makes: ACT, Heat Pipe Technologies or Carolina Heat Pipe.

2.9 FILTER SECTIONS

A. Provide all filters conforming to all requirements of specification Section 234100 and indicated on detail drawings and schedules.

B. Provide mounting frame for all pre-filter and final filters. Filter frames to be 304 stainless steel. Filters to be all upstream loaded with seals. Side access not acceptable.

Pre-filter sections shall be complete with mounting frames capable of holding pre-filters with high efficiency filters. Pre-filters shall be capable of being removed and installed without affecting seal of the high efficiency filter. Frames to be provided with closed cell gasketing and all associated clips required to hold filter cells.

C. Factory install all filter mounting frames. Frame shall be installed and individually sealed to prevent leakage around frames. Filter banks shall be reinforced with vertical stiffeners to assure rigidity. Unit manufacturer shall provide flashing between filter banks and unit casings to prevent air leakage or bypass around the frames.

D. Provide one extra complete set of all final filters and pre-filters.

E. Provide a filter magnehelic gauge for each filter bank. For combination pre-filter and high efficiency filter banks, provide filter gauge for both pre-filter and high efficiency filters. One pre-filter cell shall include standoffs and extended clips.

2.10 DAMPERS

A. All return, relief, exhaust, bypass, fan isolation and outside air dampers shall be opposed blade, aluminum, airfoil, and low leakage type design, unless otherwise noted on drawings, and conforming to all requirements of specification Section 230923. Dampers subject to corrosive fumes or humidity shall be constructed of stainless steel. Dampers exposed to unmixed direct contact with outside air to be aluminum construction, high performance, thermally insulated.

B. All dampers shall be arranged within the air-handling unit to allow the actuators to be installed within the enclosure of the units and not mounted at the unit exterior unless otherwise noted on drawings. All dampers to be surface mounted to allow for direct connection of actuators on drive shaft. Actuator shall be provided by the Controls sub-contractor.

C. Where multiple dampers are installed end to end, satisfactory clearance shall be maintained between linkages to allow for actuator linkage connections. Actuation linkage not to be attached to face of damper. Minimum damper blade width shall be 6 in.

D. Unit(s) with more than one (1) fan shall have fan isolation dampers to isolate one of the fans off-line for servicing while the remaining fan(s) continues to operate.

E. Unit(s) shall include separate minimum outside air dampers where shown on drawings. Minimum outside air opening shall be sized and arranged to accommodate outside airflow measurement station.

2.11 ELECTRICAL

A. Unit shall be field wired for lighting and receptacles. Wiring shall include but not limited to:

1. Single point connections - interior lighting. Each connection point shall have conduit through the side of the unit for extension by others.

a. Lighting connection shall be suitable for 120V single phase, 20A. Unit power requirements shall not exceed the scheduled and as indicated herein.

2. Receptacles: Provide a minimum of two 120 volt duplex receptacles on the exterior. All receptacles shall be ground fault interrupting type and have a weatherproof cast aluminum cover.

3. All electrical work and entire installation shall be in accordance with the NEC and Division 26 of these specifications. Provide thermal and moisture barrier in all conduits penetrating to air handling areas.

B. Provide internal water-tight marine lights with LED lamps and wire guards within each section of the unit that has an access door. All the lighting within the unit shall be controlled by a single centrally located electronic timer switch, switch shall have pilot light in handle.

C. All fans shall be wired to a 4x4 junction box mounted to unit exterior. Installation of wiring and conduit shall be in conformance with NEC. Field wiring from junction box to adjustable speed drive by contractor.

D. Each AHU section to incorporate an exterior 4x4 junction box with sealed conduit into airstream section to allow control subcontractor into air handling unit without any drilling through panel system in the field to compromise panel leakage integrity.

E. Provide a minimum of four (4) 3/4 in. diameter pipe penetrations, air tight, with threaded connections through the exterior and interior of unit for field use by the Installation Contractor. The pipe penetrations shall be spaced evenly along the length of the unit and shall be located on the same side as the access doors. The pipe penetrations shall be located 1 ft. down from the top of the air handling unit enclosure. Coordinate with Controls Contractor.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Contractor shall be responsible for prepping the installation location, coordinate and supervise housekeeping pad fabrication and installation, rigging all new parts and pieces onto the pad. Roof protection and/or access opening shall be coordinated prior to installation. The unit manufacturer and contractor shall then coordinate to field assemble unit to factory tolerances in place per manufacturers standards.

B. The Contractor shall assume all responsibility for equipment installation including field assembly of individual components or sections as required. All personnel shall be trained and supervised by factory representatives.

C. Provide field testing of fully assembled unit. Submit all testing reports.

D. All tubing for filter gauges, airflow station, etc. shall be hard copper type with soldered joints. Provide maximum of 1 ft. of polyethylene tubing at connections to fans which are supported by vibration isolators.

E. The unit manufacturer shall provide a factory on-site working supervisor for all phases of unit assembly including start up supervision.

F. Provide guards for all exposed shafts or fan wheels if not provided by fan manufacturer.

G. Pipe coil drip pans, humidifier and outside air sections independently to nearest floor drain, minimum pipe size shall be 1-1/2 in. Provide deep seal "P" trap and unions on both side of trap. The trap depth shall be greater than the static pressure of the section being drained. All other drain connection shall be piped with 1 in. piping manifolded together to the nearest floor drain. Provide each drain connection with ball valve and union.

H. The Contractor is responsible for cleaning of unit and repainting of any floor pans, interior walls, exterior walls, etc. that are damaged during rigging, assembly and final piping connections.

I. Air handlers shall be properly protected during shipment. Units shipped on unprotected flat-bed trailers shall be made all-weather-tight.

J. If air handlers need to be stored on site before installation within an enclosed building, all-weather-tight protection shall be maintained until the units are within an enclosed space.

K. Provide proper weatherization for protection of multi-section units during any periods of outdoor storage/staging, and during unit transport.

L. Coordinate all ductwork connection openings and unit dimensions with duct shop drawings and all other trade work prior to finalizing unit dimension specifics.

END OF SECTION

FAN COIL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services as required for the complete installation shown on Contract Drawings.

1.2 SUBMITTALS

A. Submit product data for room fan coil units and accessories.

PART 2 - PRODUCTS

2.1 GENERAL

A. Baked enamel finish of color selected from manufacturers standard colors. Each piece of equipment boxed separately and tagged by room number.

B. Shall not exceed sound data as scheduled. Acoustical data is published manufacturer's data obtained by tests in accordance with ARI Standard 350-086.

2.2 CONSOLE FAN COIL UNITS

A. Cabinets:

1. 18 gauge steel removable front enclosure so that internal operating parts are accessible for service or replacement.

2. Bar supply grilles.

3. Isolated valve compartment.

4. Access to motor, fan assembly, and filters.

5. Type as required for job conditions.

6. Return air grilles.

7. Insulated drip pan for coil and valve sections.

8. Insulated cabinet with material in compliance with NFPA 90A requirements.

B. Heating Coils:

1. Copper tubes and headers, nonferrous fins.

C. Cooling Coils:

1. Copper tubes and headers, nonferrous fins.

2. Stainless steel drain pan.

D. Motors:

1. 0-10V, variable speed, brushless DC EC Motor.

2. Built-in overload protection.

3. Resilient mountings to dissipate noise and magnetic vibration.

4. Quick detachable motor cords.

5. Fan speed controllers shall be remote flush mounted type.

E. Options:

1. Disconnect switch.

2. Pleated throwaway filter.

a. The units are equipped with 2 in. flat pleated media filters and a minimum MERV 13 rating based on ASHRAE Standard 52.2.

3. Condensate overflow switch.

a. Units shall be arranged for horizontal installation above finished ceiling, with supply and return duct connections.

F. Design Equipment: Superior Rex.

G. Make: Johnson Controls, Envirotec, Trane.

2.3 CONCEALED HORIZONTAL FAN COIL UNITS

A. Arrangement:

1. Base unit designed for fully concealed above ceiling installation.

2. Features and accessories shall be the same as console type, except as follows:

a. Units shall be arranged for horizontal installation above finished ceiling, with supply and return duct connections.

b. Fan speed controllers shall be remote flush mounted type.

B. Design Equipment: Superior Rex.

C. Make: Johnson Controls, Envirotec, Trane.

PART 3 - EXECUTION

3.1 GENERAL

A. Left hand or right hand piping connections for supply and return. Obtain complete instructions from unit manufacturer regarding each item and proper installation of same. Adjust motor speed.

3.2 INSTALLATION

A. In accordance with manufacturer's recommendations. Install piping within valve compartment to allow for pipe insulation. Provide drain piping. Vacuum clean inside of unit prior to operating units. Provide flexible duct connections at supply and return connections to concealed units. For recessed and ceiling units, coordinate location of valves, fittings, filters, with access panels, to allow for convenient service of components. Install remote speed switch for recess and ceiling units. Provide wiring.

END OF SECTION

CABINET UNIT HEATERS (HYDRONIC)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation and related work as shown on the Contract Documents.

1.2 SUBMITTALS

A. Submit product data for unit heaters and cabinet unit heaters.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Free from expansion and contraction noises and strains. Fan speed shown on Schedule shall not be exceeded. Each piece of equipment shall be factory-boxed and tagged by room number. Cabinet unit heaters and unit heaters shall have baked enamel finish with color selected by the Architect from manufacturer's standard colors. Rating in accordance with standard test codes adopted jointly by IUGA and ASHRAE.

2.2 CABINET UNIT HEATERS

A. General:

1. Rough-in dimensions must not exceed those of design equipment.

B. Cabinet:

1. Front and exposed parts, 16-gauge furniture steel, all others, 18 gauge steel.

2. Fronts shall be removable for access to interior parts.

3. Recessed or semi-recessed equipment to have four-side overlap, trim strips not acceptable.

C. Fan And Motor:

1. Fans, forward curved, centrifugal type, direct drive from motor shafts.

2. Driven by totally enclosed EC motor with overload protection and lifetime lubrication.

a. Solid state, digital control board with a three-speed switch.

3. Shall be quiet in operation, not to exceed 45 db measured 5 ft. away, at high speed.

D. Heating Element (Hydronic):

1. Nonferrous construction, copper tube, aluminum fins.

2. Multipass serpentine design for high temperature drop.

3. Manual air vent. Automatic air vent is not acceptable.

E. Hydronic:

1. Design Equipment: Sterling

2. Acceptable Makes: Airtherm, Daikin Applied, Sterling, Trane, Vulcan.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Provide equipment in accordance with manufacturer's printed instructions. Report untrue walls before installation.
Report cases where clearance below suspended heaters is less than 7-1/2 ft. Provide clearance for piping and conduit. Support units independent of piping. Support units from building structure, with screws or bolts, no nailing allowed.

B. Be responsible for proper location and size of recesses. Coordinate installation of recessed or semi-recessed equipment in recesses. Provide framing in recess and shims. Use sponge rubber gasket air-seal between front enclosure and wall.

3.2 INSTALLATION - HYDRONIC

A. Provide valves and accessories and arrange to permit servicing. Coordinate correct end connections and coil arrangements.

B. Vertical cabinet heaters that are mounted on an existing wall shall be provided with continuous wood blocking that is painted to match the wall to infill any gaps created by the baseboard.

END OF SECTION

SNOW MELT SYSTEM (PEX)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide labor, materials and equipment necessary to complete the sidewalk snow melt work of this section.

1.2 CODES AND STANDARDS

A. UL Compliance: Provide system tubing that has been listed by UL, and meets UL guide MEKC, File MH17193.

B. ASTM Testing: Provide radiant tubing that is manufactured in accordance with the following standards:

1. ASTM E 84: Burning Characteristics of Building Materials.

2. ASTM F 876-99: Standard Specification for Cross-linked Polyethylene (PEX) Tubing.

3. ASTM F 877-99: Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold-Water Distribution Systems.

4. ASTM F 2080: Standard Specification for Cold Expansion Fitting with Metal Compression-Sleeves for use with Cross-Linked Polyethylene (PEX) Pipe.

5. CSA B137.5-97: Cross-linked Polyethylene Tubing Systems for Pressure Applications.

C. The hose material shall carry a Class A N.Y.S. flame spread rating.

D. Install radiant tubing in compliance with the Standard Guidelines for Radiant Panel Installations, as approved by the Radiant Panel Association.

1.3 SUBMITTALS

A. Submit manufacturer's specifications for radiant tubing products showing dimensions, temperature capacities (both constant and intermittent), pressure ratings (both operating and burst), flow rates, material composition, and bend radius.

B. Submit shop drawings showing complete snow melt system layouts including tube spacing and manifold locations on a per zone basis, appropriate construction details, and field connection details. Include information on all parts of the system being provided by the manufacturer. Submit three (3) copies of each shop drawing.

C. Submit three (3) 12 in. samples of each type and size of radiant tubing being furnished.

D. Submit maintenance instructions, including repair of damaged components, corrosion protection instructions, and a spare parts list.

E. Submit manufacturer's written warrantee. Tubing shall have a minimum of a twenty (20) year, non-prorated commercial warranty or a limited lifetime residential warranty, even when tubing is installed at temperatures below freezing and/or is exposed to sunlight for up to 120 days. The warranty must include all costs associated with the repair and/or replacement of the hydronic system, including materials and labor.

F. Submit radiant design which must include the following information:

1. Material List:

a. A complete list of components that will be supplied.

2. Zone List:

a. Individual zone square footage with recommended tubing spacing and high intensity heating square footage.

b. Heating intensity in BTU/h/ft^2.

c. The required heat (in BTU/h), radiant capacity, and complete radiant panel loads (including back and edge losses.

d. GPM, TDH, and Delta T.

e. Tube type, length, diameter and quantity of circuits.

3. Nomograph for individual rooms indicating floor surface temperature vs. GPM vs. BTU/h/ft^2 vs. tube spacing. This report should also illustrate the required BTU/h/ft^2 and the maximum the installed floor heating system could potentially deliver.

PART 2 - PRODUCTS

2.1 SNOW MELT TUBING

A. Material: All snow melt heat pipe shall be high density cross-linked polyethylene manufactured using the high-pressure peroxide method (PEXa), with a minimum degree of cross-linking of 80% in accordance with ASTM D 2765, Method B. Pipe shall conform to ASTM F 876, F 877 and CSA B137.5, and be certified by CSA or equivalent testing organization.

B. Temperature and Pressure Ratings: Pipe shall be rated for continuous use at 100 psi at 180°F temperature, and 80 psi at 200°F temperature.

C. Oxygen Diffusion Barrier: Pipe shall have a co-extruded oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to less than 0.10 mg/l/day at 104°F water temperature, in accordance with DIN 4726.

D. Bend Radius: The minimum bend radius for cold bending of the pipe shall be not less than five (5) times the outside diameter. Bends with a radius less than this shall require the use of a bending template as supplied by the pipe manufacturer, and/or hot air.

E. Flame and Smoke Spread: Pipe to have a Flame Spread Index of less than 25, and a Smoke Developed Index of less than 50, when tested in accordance with ASTM E 84.

2.2 FITTINGS

A. Fittings shall be manufactured of dezincification-resistant brass and shall be supplied by the pipe manufacturer as part of a proven cataloged system.

B. Manifold fittings to be compression nut style with re-usable split compression ring.

C. Pipe couplings embedded within the thermal mass shall be brass cold-expansion compression-sleeve fittings. Pipe fittings to require cold expansion of pipe for assembly, and to have minimum inside diameter of 82% of pipe inside diameter. Compression-sleeve couplings shall be certified to ASTM F877, ASTM F2080, and CSA B137.5.

2.3 DISTRIBUTION MANIFOLDS

A. Distribution manifolds to be made of extruded brass pipe, tapped for connections. Manifolds shall be equipped with visual flow gauges, balancing and isolation valves for each circuit, header isolation valves and fill ports. Manifolds to be supplied completely assembled.

2.4 MANIFOLD CABINETS

A. Distribution manifold cabinets to be made from galvanized steel with welded seams. Cabinets to be adjustable for depth and height, with removable floor brackets and adjustable manifold support brackets. Cabinets to have pipe knock-outs on both sides for pipe connections to the distribution manifold. Cabinets to be provided with keyed locks.

2.5 CONTROLS

A. Snow Melt System controlled by BACS.

2.6 ACCESSORIES

A. Repair Kit: One (1) for each size of radiant tubing used on the project.

B. Cable Tie: One (1) every 18 in. (min.) of tubing.

C. Hose Unwinder: Minimum of one (1) per project.

D. Pressure Test Kit: Minimum of one (1) per project.

2.7 MAKES

A. Design Equipment: Rehau Pex-A.

B. Manufacturers: Rehau, Watts Radiant, ThermaPEX.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas and conditions in which the radiant tubing is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer, the Architect/Engineer, and/or the Owner.

B. Install tubing as indicated on drawings (plans and specs), schedules, and specifications, in accordance with the manufacturer's installation instructions. Locate tubing in the floor as indicated; cover areas continuously wall to wall at specified spacing unless otherwise indicated.

1. Install 12 in. length (6 in. on each side of joint) of PEX around radiant tubing where crossing construction expansion joint. Outer casing pipe to be minimum two nominal pipe sizes larger than carrier pipe. Final routing to be confirmed by manufacturer for all control joints. Refer to manufacturer installation requirements for additional detail.

C. Where concrete saw cutting is required have future cuts marked out on grade prior to installation of radiant tubing. Address areas of concern with contractor performing cuts prior to the installation of the radiant tubing.

D. Provide pressure testing of between 50 and 100 psi for a minimum of twenty-four (24) hours prior to, and during the pour for concrete applications; and for twenty-four (24) hours after all other applications. Install access panels centered in front of each manifold set where required.

E. Manufacturer's Representative will be on site for initial system installation to supervise design conformance. Manufacturer's Representative will take digital photographs of the initial installation. These photographs will then be turned over to the design engineer for documentation purposes.

END OF SECTION

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 ROUGHING

A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.

B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. **DO NOT SCALE** plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.

C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.

E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:

1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.

2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.2 EQUIPMENT AND MATERIAL REQUIREMENTS

A. Provide materials that meet the following minimum requirements:

1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

2. All equipment and material for which there is a listing service shall bear a UL label.

3. Potable water systems and equipment shall be built according to AWWA Standards.

4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.

5. All electrical equipment and systems, as a whole, shall be tested and listed by an OSHA approved Nationally Recognized Testing Laboratory (NRTL) for the intended use in accordance with the applicable standards and have a physical label indicating such.

1.3 CONCEALMENT

A. **Conceal all contract work** above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after their review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.4 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.

2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.

3. Assume responsibility for correct and final location and size of such openings.

4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.

5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.

6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

B. In Existing Buildings:

1. Drill holes for floor and/or roof slab openings.

2. Multiple pipes smaller than 1 in. properly spaced and supported may pass through one 6 in. or smaller diameter opening.

3. Seal voids in fire rated assemblies with a fire-stopping seal system to maintain the fire resistance of the assembly. Provide 18 gauge galvanized sleeves at fire rated assemblies. Extend sleeves 2 in. above floors.

4. In wall openings, drill or cut holes to suit. Provide 18 gauge galvanized sleeves at shafts and fire rated assemblies. Provide fire-stopping seal between sleeves and wall in drywall construction. Provide fire stopping similar to that for floor openings.

1.5 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.

2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.

6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.

7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.

B. Acceptable Manufacturers:

1. Dow Corning Fire-Stop System Foams and Sealants.

2. Nelson Electric Fire-Stop System Putty, CLK and WRP.

3. S-100 FS500/600, Thomas & Betts.

4. Carborundum Fyre Putty.

5. 3-M Fire Products.

6. Hilti Corporation.

1.6 ACCESS PANELS

A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.7 CONCRETE BASES

A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.8 HVAC EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide final hot water, glycol, chilled, drain, vent**,** connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.

C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

D. Refer to manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.9 PLUMBING EQUIPMENT CONNECTIONS

A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

B. Provide roughing and final water, waste, vent connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.

C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.

D. Install controls and devices furnished by others.

E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.

F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

G. Refer to Manufacturer drawings and specifications for requirements of special equipment. Verify connection requirements before bidding.

1.10 ELECTRICAL EQUIPMENT CONNECTIONS

A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.

B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

C. Refer to Manufacturer's drawings/specifications for requirements of special equipment. Verify connection requirements before bidding.

END OF SECTION

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The drawings are diagrammatic, unless detailed dimensioned drawings are included, and show only approximate locations of equipment, fixtures, panelboards, conduits, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Exact routings of conduit shall suit the job conditions.

B. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, the size and the quantity of branch circuit conductors, and the panel board or interconnection box from which the branch circuit is served.

C. Make measurements at the site and in the building during construction for all systems installed as the work progresses in such a manner that the equipment, piping, vents, ducts, conduit, and boxes will fit in the space available. Maintain headroom and if in unfinished areas, be as neatly installed, as obscure and "out-of-the-way" as physically possible. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and /or furnish other equipment as required for ample maintenance space.

D. Any changes in the size or location of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

1.2 QUALITY ASSURANCE

A. Electric equipment shall be installed in a neat and workmanlike manner. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.

B. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equal in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.3 SUBMITTALS

A. Submit product data for the following equipment, materials and products, including all fittings and accessories:

1. Conduit
2. Surface Raceway
3. Expansion Fittings
4. Cable Tray
5. Channel Support Systems
6. Conductors
7. Cables
8. Cable Termination and Splice Kits
9. Poke-Through Service Fittings
10. Terminal and Equipment Cabinets
11. Floor Boxes
12. Wiring Devices Including Dimmers
13. Telephone/Data Communication Outlets
14. Television Outlets
15. Extension Cord Reels
16. Clocks
17. Flashing, Sealing, Firestopping Materials
18. Salvageable Materials
19. Testing reports prior to energizing equipment and materials.

1.4 SALVAGEABLE MATERIALS

A. Salvageable materials will be reviewed and identified by the Owner. Items selected by the Owner shall be delivered to a selected location on the Owner's property by this contract in an equal condition to prior this work.

B. Items normally accepted as salvage by the Owner:

1. Transformers
2. Meters, meter sockets and test switches
3. Deadfront switchgear
4. Panelboards and covers
5. Circuit breakers
6. Disconnects (100 AMP and up)
7. Bus duct and apparatus
8. Adjustable speed drives
9. Motor starters
10. Luminaires
11. Fire alarm equipment
12. Nurse call and intercom
13. Motors above 1/2 HP and up
14. Environmental and automation control equipment
15. Telephones
16. Central clock system

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit, Raceway and Tubing:

1. Rigid Metal Conduit (RMC) shall be hot-dipped galvanized or electro-galvanized steel, UL listed "rigid metal conduit."

a. Acceptable Manufacturers:

1) Republic Conduit
2) Allied Tube and Conduit
3) Wheatland Tube
4) Approved equal

2. Electrical Metallic Tubing (EMT) shall be electro-galvanized steel with corrosion resistant zinc coating; UL listed.

a. Acceptable Manufacturers:

1) Republic Conduit
2) Allied Tube and Conduit
3) Wheatland Tube
4) Approved equal

3. Aluminum Conduit shall be rigid, heavy wall aluminum, UL listed "rigid metal conduit."

a. Acceptable Manufacturers:

1) Republic Conduit
2) Allied Tube and Conduit

4. Flexible Metal Conduit (FMC) shall be constructed of one continuous length of electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges. Shall be UL listed "flexible metal conduit" or "liquidtight flexible metal conduit" as required.

a. Acceptable Manufacturers:

1) Republic Conduit
2) Allied Tube and Conduit
3) Wheatland Tube
4) AFC (American Flexible Conduit) Cable Systems

5. Rigid Non-Metallic Conduit (Schedule 40 for concrete encasement, Schedule 80 for direct burial or where exposed) shall be UL listed "rigid non-metallic conduit" for application in underground, encased, and exposed applications in accordance with the NEC". The conduit shall be made from polyvinyl chloride (PVC) and shall be rated for 90ºC conductors.

Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3, UL-651, and UL-514

a. Acceptable Manufacturers:

1) Carlon
2) Heritage Plastics
3) PW Eagle

6. PVC Coated Rigid Metal Conduit, prior to coating shall conform to the specifications for Rigid Metal Conduit, above. The conduit shall have hot dipped galvanized threads, and the threads and the inside of the conduit shall be urethane coated. The exterior of the conduit shall be PVC coated to a minimum thickness of 40 mils. All coated conduit shall conform to NEMA standard RN01. The conduit shall be bendable without damage to the interior or exterior coatings. All fittings and couplings shall be PVC coated to a minimum thickness of 40 mils on the exterior, and the interior and threads shall be urethane coated. All screws shall be stainless steel. The installed conduit system shall provide a continuous grounding path.

a. Acceptable Manufacturers:

1) Robroy Industries
2) Ocal Incorporated
3) Perma-Cote
4) Approved Equal

7. Surface Metal Raceway shall be .040 in. steel UL listed "Surface Metal Raceway". Use manufacturer's standard fittings designed to be used with the specific raceway.

a. One-Piece Raceway:

1) Finish per architect.

2) Acceptable Manufacturers:

a) Wiremold "700" Series (Design Make)
b) Mono Systems
c) Approved equal

b. Two-Piece Raceways:

1) Finish per architect.

2) Duplex or special receptacles as specified in wiring devices.

3) Corners, turns, tees and elbows shall have suitable turning radius for the intended cable.

4) Provide divider in raceways utilized for power and communications. Utilize wire/cable clips 18 in. on center to hold in the conductors/cables.

5) Utilize rounded head screws/bolts for mounting.

6) Acceptable Manufacturers:

a) Wiremold 4000 (Design Make)
b) Approved equal

8. Electrical Non-Metallic Tubing (ENT) for installation in accordance with the National Electrical Code, other applicable sections of the Code, and local codes.

a. Any ENT used shall meet the requirements of NEMA TC-13 and shall be listed by Underwriters Laboratories, Inc., as suitable for its intended purpose.

b. ENT shall be recognized by a CABO National Evaluation Report for use in one (1) hour and two (2) hour rated construction.

c. Penetration of fire rated walls, floors, or ceilings, shall use classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Building Materials Directory.

d. Fittings and outlet boxes shall be designed for use with ENT and listed by Underwriters Laboratories. All fittings, boxes, and accessories shall be from one manufacturer.

e. Only cement recommended specifically for use with the brand of ENT used shall be used.

f. Unless indicated differently on drawings, ENT systems shall be color coded BLUE for brand and feeder circuit wiring, ORANGE and YELLOW for communications, and RED for fire alarm and emergency systems.

g. Acceptable Manufacturers:

1) Carlon
2) Heritage Plastics
3) Approved equal

B. Conduit Fittings:

1. Fittings for rigid metal conduit shall be fully threaded and shall be of the same material as the respective raceway system. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2 in. and double screw indenter fittings for conduits 2 in. and larger. Connectors shall also have insulated throat or plastic insulating bushing up to and including 1 in. size. For sizes 1-1/4 in. and larger, provide plastic insulating bushing.

Die-cast, pressure cast fittings shall not be used. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.

a. Acceptable Manufacturers:

1) O.Z. Gedney
2) Steel City
3) Thomas & Betts
4) Crouse-Hinds
5) Carlon

2. Expansion Fittings shall be watertight, combination expansion and deflection type designed to compensate for movement in any direction. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless steel bands, use aluminum body fittings for rigid aluminum conduit.

a. Acceptable Manufacturers:

1) Crouse-Hinds, Type "XD"
2) O.Z./Gedney, Type "DX"
3) Approved equal

3. Explosion-proof conduit sealing fittings shall be threaded, cast iron alloy construction with integral bushings. Seal with "A" sealing compound after wiring installation. The fittings shall be UL Listed for Class I, Division 1 and 2, Groups B, C, D; Class II, Division 1 and 2, Groups E, F, G; Class III.

a. Acceptable Manufacturer's:

1) Crouse-Hinds EYS Series
2) Emerson/O.S./Gedney EYS Series
3) Emerson/Appleton EYS Series

C. Wireway, Wire Trough, and Auxiliary Gutters:

1. Wireway and Wire Trough shall be hinged cover type wireway with provisions for full lay-in along the entire length of run. Wireway shall be steel, enclosed with gray enamel finish. Provide NEMA 1 units for interior/dry/clean locations and NEMA 12 for interior dry maintenance/shop/utility locations. Size to meet NEC fill requirements or larger as noted on Contract Documents. Provide knockouts along runs. Recess in wall where required for flush mounted equipment. Hinge shall be on the bottom of front face for horizontal mounting. Provide all covers, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, tees, pullboxes, hangers, reducers, supports, and other fittings to match and mate with wireways as required for complete system.

a. Acceptable Manufacturers:

1) Square D "Square Duct"
2) General Electric

3) Hoffman
4) Meco

D. Cable Trays:

1. Solid Bottom Cable Trays shall be aluminum construction, including accessories. One-piece construction bottom and side, sheet aluminum 080 ±5%. Aluminum alloy side rails and bottom channel with flanges in standard lengths 12 ft. - 0 in. long. Wrap around type bolted connector to connect tray sections. Cover required where indicated on Contract Documents and in all areas used as return air plenums. Use three-piece construction, consisting of a solid corrugated bottom welded to the side rails. Provide divider strip where noted on Contract Documents. Minimum inside radius of horizontal elbows shall be 12 in. Provide special radius elbows where required for field conditions. Horizontal and vertical bends for solid bottom trays shall have solid bottoms. Loading data:

Tray Width	Load Depth	Usable NEMA Depth	Standard	Span	Lbs. Per Feet	Deflection
12 in.	4 in.	3 in.	12B	10 ft.	115	0.15 in.
18 in.	4 in.	3 in.	12B	10 ft.	115	0.015 in.
18 in.	6 in.	3 in.	12C	10 ft.	144	0.15 in.

a. Provide a safety-loading factor of 1.5 for uniformly distributed loads when supported as a simple span in accordance with the NEMA standard listed.

b. Acceptable Manufacturers:

1) P-W
2) B-Line Systems
3) Chalfant
4) Globe

E. Strut-Type Channel Raceways and Fittings:

1. Strut-Type Channel Raceways and Fittings shall be provided for racking of conduit, trapeze suspensions, equipment support, cable racks and panel racks. Channel shall be steel with electroplated zinc finish for interior dry locations. Provide necessary accessories such as bolts, screws, anchors, connection plates, and straps as required to perform the necessary functions. Wet location and exterior channel support systems shall be steel with hot dipped galvanized finish and stainless steel hardware as a minimum. Cut ends shall be touched up with suitable matching finish. Provide poured-in-place inserts for supporting channels at poured concrete walls and ceilings.

a. Acceptable Manufacturers:

1) Unistrut
2) Globe

3) Kindorf
4) B-Line

F. Low Voltage (600V or less) Conductors and Cables:

1. Conductors shall be insulated for 600 volts, unless otherwise noted, and shall be standard AWG and kcmil sizes. Conductors shall be 98% copper, thermal plastic or cross-linked polymer insulated, heat and moisture resistant. Conductors shall be stranded, except for conductors used for fire alarm system wiring. Conductor sizes No. 18 AWG and smaller shall be a solid single strand; No. 16 AWG and larger shall be multiple stranded. Minimum conductor size shall be #12 AWG except smaller sizes may be used for communications and special systems. Conductor sizes shall be as called for. Conductors shall be labeled with UL seal and be marked with the manufacturer's name, wire size and insulation type. Insulation for all 600 volt conductors shall be Type THHN/THWN-2 or Type XHHW-2, unless otherwise noted. All exterior and underground conductors shall be XHHW-2. Luminaire fixture wire shall conform to the latest Underwriters Laboratories requirements. Flexible cords and cables for general portable use shall be Type SO or SOOW or as noted. Cables for special use shall be of the type specified for the application.

a. Color Coding:

1) All circuits shall be color coded according to the following schedule.

	Three Phase 120/208V	**Three Phase 277/480V**
Ground	Green	Green
Neutral	White	Gray
A or L1	Black	Brown
B or L2	Red	Orange
C or L3	Blue	Yellow
Isolated EG	Green w/Yellow Tracer	Green w/Yellow Tracer

b. Acceptable Manufacturers:

1) General Cable (Brand of Prysmian Group)
2) Prysmian
3) South Wire
4) Okonite
5) Senator

2. Mineral Insulated (MI) Cable:

a. Cable shall be a manufactured system rated for two (2) hour fire rating minimum and be NRTL tested for such.

System shall be rated 600V, continuous 90°C minimum and have a main copper conductor, magnesium oxide insulating material and outer soft drawn copper sheath. Jacket of low smoke material with conductor size and rating markings labeled.

b. Utilize manufacturer termination kits for entry into boxes, panelboards, etc. Maximum of 6 ft. distance between cable supports and secured to fire rated building structure. Manufacturer installation instructions/recommendations shall be strictly followed. Provide phasing color coding utilizing tape at each enclosure, box and junction.

c. Acceptable Manufacturers:

1) Pyrotenax
2) Approved equal

3. Terminal Lugs and Connectors:

a. The lug shall be capable of continuous operation at the current rating of the cable it is used on. The lug shall be UL listed per UL 486A, using industry standard crimping tools and dies. Terminal lugs shall be solderless, pressure type with UL label for "CU/AL" conductor terminations. The lug shall be a closed-end compression (crimp) type, constructed of seamless, alloy suitable for copper and/or aluminum conductors to match the conductor. The lug shall be made with a chamfered inside end, for ease of conductor insertion. Both one and two hole lugs shall be NEMA sized for standard stud sizes and spacing. The lug shall be designed for use at the system voltage.

1) Acceptable Manufacturers:

a) 3M Scotchlok 30,000 and 31,000 Series
b) Burndy
c) O.Z./Gedney
d) Thomas and Betts

b. The conductor connection shall be capable of continuous operation at the current rating of the cables it is used on. The connection shall be UL listed per UL 486A, using industry standard crimping tools and ides. The connector shall be an inline compression (crimp) type, constructed of seamless, tin-plated copper. The connector shall be constructed with chamfered inside-ends and with center cable stops. The connector shall be designed for use at the system voltage.

1) Acceptable Manufacturers:

a) 3M Scotchlok 10,000 and 11,000 Series
b) Burndy
c) O.Z./Gedney
d) Thomas and Betts

c. "Split-bolt" Connectors shall be solderless type.

1) Acceptable Manufacturers:

a) Burndy
b) Kearney
c) O.Z./Gedney
d) Thomas and Betts
e) Anderson

d. "TWIST ON" Connectors shall be spiral steel spring type and insulated with vinyl cap and skirt.

1) Acceptable Manufacturers:

a) 3-M Company "Scotch-Lok"
b) Ideal "Wing-Nuts"
c) Approved equal

e. Aluminum joints shall utilize oxide inhibitors as recommended by the conductor manufacturer. Utilize pin type terminations where possible and coordinated with the clearances available. Provide insulating tape or insulating sealed cover for connectors/terminations.

G. Outlet Boxes, Device Boxes, Rings, and Covers:

1. Outlet Boxes having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit or cable fittings, or cables, with provisions for mounting outlet box cover. Outlet boxes shall be galvanized steel, not less than 2-1/2 in. deep, unless restricted by the surroundings, 4 in. square or octagonal. Boxes and associated fittings, plates and devices shall be mechanically fastened (screwed), friction fitting is not acceptable. Outlet boxes exposed to moisture, surface mounted, exterior, wet or damp locations shall be cadmium cast alloy complete with external threaded hubs and gasketed screw fastened covers. Minimum box size shall be as indicated in the NEC for the conductors and devices installed. Boxes shall be approved for the environmental condition where they will be installed.

2. Conduit bodies providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point and listed in accordance with outlet box requirements.

3. Extension ring intended to extend sides of outlet box or device box to increase box, volume, or both

a. Acceptable Manufacturers:

1) Steel City
2) Raco
3) Appleton
4) Crouse Hinds

4. Telephone/Data Communications Outlet Boxes:

   a. 4 in. x 4 in. outlet box with single gang plaster ring with cover plate suitable for indicated communications outlet and conduit routed to accessible ceiling space / accessible corridor ceiling space cable tray. Cover plate shall match the receptacle cover type.

5. Pull and junction boxes shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type covers. Boxes installed in damp or wet locations shall be of raintight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated NEC for conduit and conductor sizes installed. Boxes shall be approved for the environmental condition of the location where they will be installed.

   a. Acceptable Manufacturers:

      1) Hoffman
      2) Keystone
      3) Approved equal

6. Flush floor junction boxes shall be recessed cover boxes designed for flush mounting in masonry. Provide checkered plate gasketed cover suitable for foot traffic. Make: O.Z. Gedney Type YR or approved equal.

7. Corrosion Resistant Boxes:

   a. Provide corrosion resistant boxes for sewage pump stations, natatoriums, etc. and where indicated.

   b. Plastic Coated Outlet Boxes: threaded hub type, malleable iron boxes coated with 40mils thick polyvinylchloride coating, Ocal/T&B Ocal Blue System, PCD Corp. KorKap XL or Robroy Industry Plastibond or Perma-Cote.

   c. Nonmetallic Boxes: Glass fiber reinforced polyester, Carlon Himeline Series, Crouse-Hinds Krydon or Robroy Industry Stahlin.

8. Hazardous location conduit junction boxes shall be used in hazardous locations to provide for change in conduit direction, access to conductors, and as pull and splice boxes. They shall be copper free aluminum, with internally threaded bodies and cast in brackets on the cover. The boxes shall be UL Listed for Class I, Division 1 and 2, Groups B, C, D; Class II, Division 1 and 2, Groups E, F, G; Class III.

   a. Acceptable Manufacturers:

      1) Crouse-Hinds EGJ Series
      2) Emerson/O.Z./Gedney GUEB Series
      3) Emerson/Appleton DER/GUB and GUBM Series

9. Flush Floor Boxes: Boxes shall be cast in place with height adjustability prior to pour. Provide power, communication and/or audio/visual outlets as indicated. Installation shall be suitable for the intended floor finish: if carpet, then provide a carpet flange, if tile/terrazzo/concrete finish, then provide a collar flush with finished floor and no flange. Units shall meet UL scrub water protected requirements. To have integral ground terminal.

    a. Acceptable Manufacturers:

        1) Acceptable manufactures shall include those called for in the Contract Documents.

10. Flush Poke-Through Service Fitting (Power/Communication):

    a. Provide flush poke-through suitable for installation in a cored floor opening. Shall be complete with junction box, conduit and conduit adapter for transition from the floor box to movable partitions or with flush devices as indicated on plans. The complete assembly shall be suitable for two hour fire rated floors, be UL CEYY listed and have UL scrub water protected metallic color as selected by the Architect cover and trim ring. Cover shall be suitable for carpet, tile, wood and concrete. Unit protrusion above floor plane shall not exceed 0.2". Extend or reduce unit raceway length as needed to accommodate floor thickness and project conditions. Provide indicated devices in units.

    b. Acceptable Manufacturers:

        1) Acceptable manufactures shall include those called for in the Contract Documents.

H. Terminal and Equipment Cabinets:

1. Terminal and equipment cabinets shall be code gauge galvanized steel with removable endwalls. Fronts shall be of code gauge steel, flush or surface type (as indicated) with concealed trim clamps, concealed hinges, flush lock, and grey baked enamel finish. Boxes and front shall be UL listed and shall be minimum 35 in. H x 24 in. W x 6 in. D. Provide removable insulated plywood terminal board mounted on inside back wall of cabinet.

    a. Acceptable Manufacturer:

        1) Square D "Mono-Flat"
        2) Approved equal

I. Wiring Devices:

1. Wiring Devices (toggle switches, key switches, receptacles, dimmers, occupancy sensors, etc.) shall be commercial grade as a minimum. Switch handle and receptacle face shall be as directed by the Architect. Receptacles connected to the emergency power system shall have a red colored face.

Provide device cover plates of rounded nylon colored to match the device in finished areas and rounded raised (Steel City 450/460 series) only for surface mounted locations in unfinished areas. Provide neoprene gasketed cast aluminum/zinc box with hinged (for receptacle) rain tight cast aluminum/zinc lockable while in use cover with stainless steel hardware for devices designated "WP".

a. Acceptable Manufacturers:

1) Pass and Seymour
2) Hubbell
3) Leviton

2. Toggle/Snap Switches:

a. Units shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, 90° rear plug in termination with pig tail, with nylon/polycarbonate toggle, self grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20. Single pole units shall be Hubbell HBL1221, P&S 20AC1 or Leviton 1221-2. Provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model.

b. Momentary Contact: Units shall be as indicated above (20A, 277V, nylon handle, side/back wired), three position, two circuit/three wire with spring return to center position, provide where indicated and as needed for proper system operation. Hubbell HBL 1557, P&S 1250, Leviton 1256 or approved equal. Provide keyed operation or pilot light where indicated. When used for lighting controls for vacancy sensor control, provide jumper across the circuit terminals.

3. Receptacles:

a. Provide receptacles where indicated on the drawings and where called for. Provide type receptacle as indicated and if not indicated then utilize general receptacle.

b. General Receptacle: Units shall be NEMA 5-20R, duplex, 20A, 125V, 90° rear plug in termination with pig tail with nylon face, indented brass contacts for three point connection, self grounding stainless steel mounting screw clip plate and green ground terminal. Shall meet requirements of Federal Specification W-C-596, NEMA WD-6 and UL 498.

1) Units shall have 0.036" brass thick contacts, 0.05" thick brass mounting strap, and be: Hubbell HBL5362, P&S 5362A or Leviton 5362.

c. Ground Fault Interrupting Receptacles: Units shall be as specified above for General Receptacle and have 5mA interrupting ground fault level, test/reset front buttons, full through feed capability, power off on reverse wired sensing, 10kA short circuit current rating, be tamper/weather resistant and in compliance with UL 943. Unit shall self-test function to periodically test the components automatically and indicate a failure condition utilizing an LED. Shall be Hubbell GFR5362, P&S 2096TR or Leviton S7599TR.

d. Tamper Resistant Receptacles: Units shall be as specified above for General Receptacle and have protective shutters to prevent entry into the line or grounded front openings unless all plug prongs are present.

e. Surge Protected Receptacles: Units shall be as specified above for General Receptacle and have 240 joule energy/15,000A capacity, three modes of protection (line to neutral, line to ground and neutral to ground), 500V maximum clamping, LED indicator (operational, failure), blue color and UL 1449 compliant. Shall be Hubbell HBL5360SA, P&S 5352XSP or Leviton 5280.

f. Isolated Ground Receptacles: Units shall be as specified above for General Receptacle and have an orange color and electrically independent/isolated mounting strap and ground terminal. Shall be Hubbell IG5352, P&S IG5362 or Leviton 5362IG.

g. Surge Protected and Isolated Ground Receptacles: Units shall be as specified above for General Receptacle and the Surge Protected and Isolated Ground units above. The unit shall have an orange color.

h. Controlled Receptacle: To be utilized where a receptacle is automatically controlled. Units shall be as specified above for General Receptacle with suitable symbol on face. Shall be Hubbell DR20LA, P&S 26352CD or approved equal.

i. USB Power Receptacle: Units shall be as specified above for General Receptacle but have 0.040" zinc plated mounting strap, two 20A 125V outlets and two USB charging (5A minimum total, 5VDC, USB 2.0/3.0) outlets. Overall depth shall not exceed 1.7 in. Shall be Hubbell USB20 or approved equal.

j. Clock Receptacle: To be NEMA 5-15R single receptacle with hanger and stainless steel cover plate. Hubbell HBL 5235 or approved equal.

k. Special Receptacles: provide other type receptacles as indicated herein or on the drawings. Such receptacles shall be Hubbell, P&S or Leviton highest grade available.

4. Extension Cord Reels:

a. Ceiling mounted. Positive stop action at any length, ratchet lock, and automatic rewind spring.

Provide heavy duty type with 20 ft. of #12/3 SJEO minimum cord terminating in molded high impact outlet box with wire mesh cord grip and P&S #5362A or HBL 5362 receptacle (brown), and spring close cover plate. Provide rigid mounting support to building structure.

b. Acceptable Manufacturers:

1) Hubbell HBL45123R20 (Design Make)
2) Woodhead
3) Appleton RL5000 Series

5. Time Switches:

a. Electromechanical Controllers:

1) DPST, 40A per pole at 277 volt: Tork 7202Z.

2) 3PST, 40A per pole at 277 volt: Tork 7302Z.

3) Two-circuit lighting control center: Tork T-920L.

4) Three-circuit lighting control center: Tork T-903-L.

b. Digital Time Switch (for use with Contactor):

1) SPDT, 7-day with 14 set points.

2) Digital, AM/PM Clock with LCD display.

3) Battery backup to keep program in memory for approximately seven (7) days.

4) 120V Make: Tork EW120 or equal.

5) 277 Make: Tork EW120-3 or equal.

c. Time switches shall be provided with NEMA 1 general purpose, surface mount enclosures unless otherwise noted.

6. Elapsed Time Switches:

a. Mechanical spring wound timer, which requires no electricity to operate the timing mechanism. Device shall fit a standard 2-1/2 in. deep wall box. Switch contacts shall break current carrying contacts at the end of the timed cycle.

1) 0-30 Minutes: Tork A530M or equal.
2) 0-4 Hours: Tork A504HH or equal.
3) 0-12 Hours: Mark Time or equal.

7. Emergency Shutdown Pushbutton:

   a. Where called for provide emergency shutdown/emergency power off push button. Unit shall be Square D Class 9001 Type K NEMA 13 oil tight pushbutton with the following:

      1) Red mushroom head 1-1/2 in. button, hinged protective flip up cover, push to operate, pull to reset.

      2) Maintained contact operation with one normally open and one normally closed 10A 120V contacts. Provide relay for additional contacts.

      3) Red pilot light.

      4) Engraved legend plate indicating "XX - Emergency Stop" with XX = the system name.

8. Cable Rack Assembly: Non-metallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

   a. Support Stanchions: Normal 36 in. high by 4 in. wide, with minimum of nine (9) holes for arm attachment.

   b. Arms: Arranged for secure, drop-in attachment in horizontal position at any location of cable stanchions, and capable of being locked in position. Arms shall be 12 in. minimum and rated for twice the intended weight as a minimum. Top of arm for cable support shall be nominally 4 in. wide, and arm shall have slots along full length for cable ties.

   c. Support shall have rounded corners and be securely fastened to the arm and cable fastened to it with tie wrap or other recommended method.

   d. Hardware: All hardware shall be stainless steel.

J. Flashing, Sealing, Fire-stopping:

1. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

   a. Provide materials and products listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.

   b. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.

c. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.

d. The methods used shall incorporate qualities, which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

2. Acceptable Manufacturers:

a. Dow Corning Fire-Stop System Foams and Sealants
b. Nelson Electric Fire-Stop System Putty, CLK and WRP
c. S-100 FS500/600, Thomas & Betts
d. Carborundum Fyre Putty
e. 3-M Fire Products

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA NEIS (National Electrical Installation Standard) latest edition.

B. Unless otherwise noted, wiring for all systems indicated in the contract documents shall consist of insulated conductors installed in raceways. Raceways shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond raceways to all boxes and cabinets so that each system of raceways is electrically continuous throughout. Unless otherwise indicated on the drawings, install all wiring in the following raceway system:

1. Wiring 600 Volts or Less in Dry Locations: EMT.

2. Wiring 600 Volts or Less in Dry Locations and Subject to Physical Damage: RMC.

3. Wiring 600 Volts or Less in Outdoors, Above Grade Locations: RMC.

4. Wiring 600 Volts or Less Installed Below Grade, in Concrete Floor Slabs or Below Ground Floor Slab: PVC-40 encased in concrete with rigid metal conduit bends and penetrations through building floors and walls.

5. Wiring Installed in Hazardous Locations: Galvanized Rigid Metal Conduit.

6. Wiring Installed in Corrosive Locations: PVC-80, RMC-PVC.

7. Flexible metal conduit shall be used for final connection to all motors, final connection to rotating or vibrating equipment, final connections to dry type transformers and final connections to recessed lighting fixtures. Liquidtight flexible conduit shall be used in all wet or damp locations.

Maximum length of flexible conduit shall be 36 in., except that from outlet boxes to lighting fixture maximum length shall be 6 ft. Provide green insulated equipment grounding conductor in all flexible metal conduit.

8. Surface metal raceway shall be used for surface runs in finished area where concealed conduit cannot be run or where specifically indicated on drawings.

C. Raceways:

1. Sized as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, and type of the insulation conductors to be installed. Raceways shall be minimum 3/4 in. trade size for branch circuit wiring and minimum 1 in. trade size for all telephone, data, intercommunications, instrumentation, fire alarm, television and computer systems and for all branch circuit "Home Runs" to panelboards. Installed to provide adequate grounding between all outlets and the established electrical system ground.

2. Arranged in a neat manner for access and allow for access to work installed by other trades.

3. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts handtight, plus one-quarter turn more.

4. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4 inch trade size and insulated throat metal ground bushings on 1-1/2 inch trade size and larger conduits terminated with locknuts. Install throat metal grounding bushings on service conduit.

5. Complete raceway installation before starting conductor installation.

6. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 feet above finished floor. Wherever a cluster of four (4) or more raceways rise out of floor exposed, provide neatly formed 6 in. high concrete envelop, with chamfered edges, around raceways.

7. Installed with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the raceway. Factory made bends are acceptable and should be considered for raceways larger than 2 in.

8. Make bends in raceway using large-radius performed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.

9. Conceal conduit within finished walls, ceilings, and floors unless otherwise noted, or where permitted by the Owner's Representative.

All exposed raceways shall be painted to match existing adjacent surface as directed by the Architect. Install conduit parallel or perpendicular to building lines.

10. Support conduit within 12 inches of enclosure to which attached.

11. Seal raceway opening that penetrate rooms or walls with acoustical requirements on both sides of rooms or walls with acoustically rated putty or firestopping.

12. Differing Temperatures: For raceways routed between areas with differing temperatures (interior to exterior, walk in coolers/freezers, environmental chambers, etc.) install raceway as follows:

    a. Provide a thermal break, 4 in. minimum of stainless steel or Schedule 40 PVC conduit within space wall/separation.

    b. Seal raceway penetration through the wall/separation.

    c. Provide a box on each side of the space wall/separation.

    d. Provide raceway interior sealant (duct seal or suitable foam) to provide a complete air barrier after conductors are installed.

    e. Mounting of raceway and boxes on equipment shall be coordinated and approved by the equipment manufacturer.

    f. Installed with exterior surfaces not less than 6 in. from any surface with normal operating temperature of 200°F or higher.

13. Expansion-Joint Fittings:

    a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg. F and that have straight-run length that exceeds 25 feet. Install in runs of aboveground RMC and EMT conduit that are located where environmental temperature change may exceed 100 deg. F and that have straight-run length that exceeds 100 feet.

    b. Install expansion fittings at locations where conduits cross building or structure expansion joints.

    c. Install with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

    d. Installed such that no undue stress is placed on any electrical raceway due to the proper functioning of expansion joints.

14. Raceway installed in wet/damp locations or on exterior walls shall have a spacer manufactured for this purpose provided to maintain a space/void between the mounting surface and the raceway.

15. Do not install conduits within 2 inches of the bottom side of a metal deck roof.

16. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

17. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs. Bush where necessary.

18. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

19. Plugged at the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.

20. Installed with UL approved rain-tight and concrete-tight couplings and connectors.

21. Raceways shall not be attached to or supported by wooden plug anchors or supported from mechanical work such as ductwork, piping, etc.

22. Raceways installed in concrete slabs shall be located so as not to affect structural integrity of slab, and such that conduit shall have a minimum of 1 in. of concrete cover on all sides. Obtain approval from the Owner's Representative prior to installing conduit larger than 1 in. trade size in concrete slabs. Raceways in slabs shall be for floor box use only, or routing vertically through.

23. Raceways installed below ground floor slab shall be encased in concrete with 3 in. minimum coverage on all sides. Where possible, install conduit directly below slab with concrete envelope poured monolithic with slab. Where this is not possible, support raceways and envelop maximum 5 ft. - 0 in. on centers from underside of structural slab by means of galvanized pipe hangers. Pipe hangers shall be coated with asphalt mastic. Installation shall maintain integrity of waterproofing membrane.

24. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.

25. Become familiar with the general construction of the building and place sleeves, inserts, etc., as required. All penetrations through existing floors shall be core drilled and sleeved.

26. All raceways shall be supported adequately by malleable iron pipe clamps or other approved methods. In exterior or wet locations, supports shall allow not less than 1/4 in. air space between raceway and wall. Firmly fasten raceway within 3 ft. of each outlet box, junction box, cabinet or fitting. The following table lists maximum spacing between conditions, strength of supporting members, etc.

27. Furnish and install such supports at no additional cost to owner.

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
1/2 in., 3/4 in.	Concealed	7	10
1 in., 1-1/4 in.	Concealed	8	10
1-1/2 in. and larger	Concealed	10	10
1/2 in., 3/4 in.	Exposed	5	7
1 in., 1-1/4 in.	Exposed	7	8
1-1/2 in. and larger	Exposed	10	10

28. Where raceways puncture roof, install pitch pockets as required in order that the roof warranty is maintained. Coordinate with representative of roofing material manufacturer.

29. At each flush mounted panelboard, terminal cabinet, control cabinet, etc., provide four (4) spare 3/4 in. raceways from panelboard, etc., to an area above the nearest accessible ceiling space. Make 90° turn above the ceiling, arranged for further continuation of raceway, and cap.

30. All interior conduit used for the following systems shall be color coded as follows:

    a. Red - Fire Alarm System

    b. Metallic (silver/grey) - Normal utility power

    c. Yellow - Emergency Life Safety Branch

    d. Purple - Emergency Optional Standby

D. Cable Trays:

1. Tray supports shall be hung using threaded, galvanized rod hangers, with rods extended through support steel and double nutted. Size support member within load rating of member section; and without visible deflection. Install cable tray level and straight.

2. Provide aluminum body expansion connectors at building expansion joints. Minimum 4 in. movements, greater if expansion movement conditions warrant. Provide aluminum body expansion connectors every 100 ft. for outdoor installations. Minimum 4 in. movement, greater if expansion movement conditions warrant.

3. Provide external grounding strap at expansion joints, crossovers and at other locations where tray continuity is interrupted.

4. Provide necessary elbows, tees, crosses, risers, offsets, fittings, reducers, connectors, clamps, rod suspension, trapeze hangers, etc., as required to make a complete job, coordinate with the manufacturer.

5. Provide conduit to tray fitting at each conduit entrance to tray.

6. Install divider in trays as called for.

7. Install fire stop wall frames around cable tray at penetrations through fire rated walls, and where called for. Seal these openings with pliable fire resistant sealant.

E. Outlet Boxes:

1. Consider location of outlets shown on drawings as approximate only. Study architectural, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Owner's Representative for decision prior to installation. Comply with the NEC relative to position of outlet boxes in finished ceilings and walls.

2. Prior to installation, relocate any outlet location a distance of 5 ft. in any direction from location indicated on drawings if so directed by the Owner's Representative. Prior to completion of wall construction, adjust vertical height of any outlet from height indicated if so directed by Owner's Representative. The above modifications shall be made at no additional cost to the Owner.

3. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Outlet boxes shall be sized to accommodate the wiring, splices and device(s) to be installed in accordance with the NEC.

4. Saw-cut opening for boxes recessed in masonry walls in center of cell of masonry block and install box flush with surface of wall. Box shall have extra-deep type raised tile covers or shall be 3-1/2 in. deep boxes with square corners and dimensions to accommodate conductors installed. Prepare block surfaces to provide a flat surface for a raintight connection between box and coverplate or supported equipment and box, whether installed indoors or outdoors.

5. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

6. Locate boxes so that cover or plate will not span different building finishes. Install a device cover plate over each and every outlet indicated on drawings. Do not install plates until painting, cleaning and finishing of surfaces surrounding the outlet are complete.

Install single one-piece multi-gang covers over multi-gang devices.

7. Where outlets at different mounting heights are indicated on drawings adjacent to each other (due to lack of physical space to show symbol on drawings), install outlets on a common vertical line.

8. Where switch outlets are shown adjacent to strike side of door, locate edge of outlet box approximately 3 in. from door frame.

9. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

10. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

11. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

12. Floor outlet boxes shall be installed flush with finished floor, adjust level and tile as required. Where finished floor is terrazzo, provide boxes specifically designed for installation in terrazzo. Where floors are to receive carpet or flooring material, coordinate with appropriate trade and provide insert. Rectangular covers shall be parallel and perpendicular with the building or, if used, floor tile/floor joints/pattern. Coordinate cover type with the flooring and device type.

13. Outlet boxes installed in plaster, gypsum board or wood paneled hollow cavity walls shall be installed flush with raised plaster covers or raised tile covers. Boxes shall be mechanically fastened and supported by two (2) adjacent structural members (studs) with cross brackets (Garvin Industries Model BMB or approved equal).

14. Surface ceiling mounted outlet boxes shall be minimum 4 in. square, 1-1/2 in. deep, galvanized sheet metal.

15. Surface wall mounted outlet boxes shall be cast type boxes.

16. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

17. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

18. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty for boxes and enclosures in areas of walls with acoustical requirements. Provide gaskets for wallplates and covers.

19. Seal openings and knockouts in back and sides of boxes and enclosures in areas of walls with lead shielding requirements.

F. Wiring Methods:

1. Conductors shall not be installed until raceway system, including all outlets, cabinets, bushings and fittings, is completed. Verify that all work of other trades which may cause conductor damage is completed. Use only U.L. approved cable lubricants when necessary. Do not use mechanical means to pull conductors No. 8 or smaller.

2. In general, conductors shall be the same size from the last protective device to the load.

3. Wiring systems shall be properly grounded and continuously polarized throughout, following the color-coding specified. Connect branch circuit wiring at panelboards, as required, in order to provide a "balanced" three-phase load on feeders.

4. Provide insulated green ground conductor in each branch circuit.

5. All feeder connections shall be made to bus and other equipment using solderless, pressure type terminal lugs.

6. Branch circuits connected to a 20A circuit breaker shall be sized as indicated except for lengths exceeding 75 ft. For circuits longer than 75 ft. to 100 ft. utilize No. 10 AWG conductors (line, neutral and ground) and for circuits from 100 ft. to 150 ft. utilize No. 8 AWG (line, neutral and ground) unless otherwise indicated. Conduit size shall be modified in accordance with the NEC.

7. For splices and taps, No. 10 AWG and smaller, use solderless "twist on" connectors having spiral steel spring and insulated with a vinyl cap and skirt.

8. For splices and taps, No. 8 and larger, use insulated solderless set screw AL/CU or hydraulically compressed sleeve fittings suitable for the intended use.

9. Use cast connections for ground conductors.

10. Provide minimum 6 in. of spare/slack of each conductor in each junction or pull box and termination.

11. Make all splices and connections in accessible boxes and cabinets only.

12. Cover uninsulated splices, joints, and free ends of conductor with rubber and friction tape of PVC electrical tape. Plastic insulating caps may serve as insulation. Heat shrink sleeves shall be acceptable for crimp type splices.

13. On termination at branch circuit outlets, leave a minimum of 8 in. free conductor for installation of devices and fixtures.

14. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner's Representative and receive written approval for splicing prior to installation of feeder(s).

Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors as near equal as possible.

15. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equal.

16. Provide conduit seals and explosion proof devices as indicated on the plans and as dictated by the NEC for all hazardous locations indicated on the drawings.

17. Lighting fixtures, detectors, etc., in mechanical equipment, boiler and pump rooms shall be installed with exposed wiring after equipment, ductwork, piping, etc., are in place. In general, lighting shall be as located on the drawings; where conflicts exist, locate lights for best distribution.

18. Fire proof tape all medium voltage cables in handholes, man holes, building entrance and junction/pull boxes.

19. Medium voltage cables shall be installed, terminated and tested by trained and qualified personnel with a minimum of 5 years' experience. Training shall be for all types of installations and for the specific types of splices/terminations. Installation shall be in accordance with the cable manufacturer and IEEE. Provide circuit tagging with engraved phenolic plate attached with UV resistant tie wrap indicating source, circuit # and date installed with 3/16 in. test.

20. Provide cable/conductor vertical support in accordance with the NEC.

21. The following systems are permitted to be installed in cable tray in compliance with the NEC:

    a. Communication cable.

    b. Security cable.

G. Receptacles:

1. Ground opening shall be up for vertical installation and on the left for horizontal installation.

H. Toggle Switches:

1. Switches shall be installed in accessible locations near room/space entryway(s).

2. Provide lighted handle switches in mechanical rooms, elevator pits, electric rooms, etc.

3. Switches shall have neutral pulled through the box even if not used.

I. Junction and Pull Boxes:

1. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and size as require by the National Electrical Code.

J. Equipment Mounting Heights: Coordinate with architectural interior and exterior elevations.

1. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:

a.	Toggle switches (up position "on")	46 in.
b.	Wall lighting controls (dimmer, digital switch, etc.	46 in.
c.	Receptacle outlets (long dimension vertical, ground" pole farthest from floor)	18 in.
d.	Receptacle outlets above counters	8 in. above counters
e.	Receptacle outlets, above hot water or steam baseboard heaters. Do not install receptacle outlets above electric baseboard heaters	30 in.
f.	Receptacle outlets, hazardous areas; also for refrigerators	48 in.
g.	Receptacle outlets, weatherproof, above-grade	24 in.
h.	Clock outlets (104 in. AFF or 10 in. below ceiling, whichever is lower) For large, high spaces, coordinate with Architect.	104 in.
i.	Telephone outlets	18 in.
j.	Telephone outlets, wall mounted	46 in.
k.	T.V. outlet	18 in.
l.	Fire alarm manual stations	46 in.
m.	Fire alarm combination audio/visual and standalone visual device (entire strobe lens at heights indicated)	80 in. to bottom of the notification device

n.	Standalone fire alarm audio device	90 in. (min) to 96 in. (max)
o.	Distribution panelboards, to top of backbox	72 in.
p.	Terminal cabinets, control cabinets, to top of backbox	72 in.
q.	Disconnect switches, motor starters, enclosed circuit breakers.	48 in.

2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Owner's Representative for approval to change location before installation.

K. Hangers and Supports:

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, large circuit breakers, pendant mounted lighting fixtures, etc.

2. Panelboards, disconnect switches, circuit breakers, cabinets, large pull boxes, adjustable speed drives, cable support boxes and starters shall be secured to the building structure and not supported from conduits. Small panelboards, etc., as approved by Owner's Representative, may be supported on walls. Racks for support of conduits and heavy electrical equipment shall be secured to building construction by substantial structural supports.

L. Identification:

1. Provide engraved lamicoid identification nameplates on switchboards, main service disconnects, transfer switches, motor control centers and on all panelboards using designation shown in panelboard schedule. Include voltage, phase, equipment served, voltage source to panel or equipment.

2. Provide engraved lamicoid identification nameplates for each circuit breaker in the main distribution panel listing the panelboard or equipment connected to each device.

3. Provide engraved lamicoid identification nameplates on all items of equipment including individual circuit breaker enclosures and disconnect switches, listing the equipment connected to the particular device provided under Specification Section 262000, including, but not limited to: starters, disconnect switches, adjustable speed drives, circuit breakers, etc. Include voltage, phase, equipment served, voltage source to panel or equipment.

4. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker. Directory shall be placed in a plastic clear sleeve in the interior of the panelboard door. Provide type written updated panelboard directories for existing panelboards affected by this work.

5. Nameplates shall be engraved black, with white core, with Helvetica medium 3/16 in. lettering. 1/8 in. lettering is acceptable where space of 3/16 in. is not available.

6. Identify junction and pullboxes for particular service and circuit such as power, emergency power, lighting, fire alarm, telephone, interphone, public address, nurse call, etc. using stencil lettering on cover.

7. Where voltage exceeds 600V provide permanent signage indicating "DANGER - HIGH VOLTAGE - KEEP OUT". Provide signage at each electrical room indicating "DANGER - ELECTRICAL ROOM". Utilize adhesive backed, yellow background, block lettering signage at door.

8. Using adhesive backed printed tape label (white background, black lettering) all receptacle and switch coverplates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to outside of receptacle or switch coverplates.

M. Spare Parts:

1. Deliver to Owner and obtain receipt for spare parts including key switches, fuses, etc.

3.2 TESTS

A. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform the function for which they are designed. For all feeder and exterior branch circuit wiring rated 600 volts or less, provide 1,000 volt "Megger" insulation test prior to energizing feeders. Use a 1,000-volt motor driven megger for all tests. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors. Document test results and submit for approval prior to energizing conductors.

END OF SECTION

GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide grounding system equal to or exceeding the requirements of NEC and as indicated in the contract documents. Raceway system which includes metal conduit, wireways, pull boxes, junction boxes, busway, wire ways, cable trays, enclosures, motor frames, etc., shall be made to form a continuous, conducting permanent ground circuit of the lowest practical impedance to enhance the safe conduction of ground fault currents and to prevent objectionable differences in voltage between metal non load current carrying parts of the electrical system.

B. Provide solid grounding of building structures and electrical and communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits and systems. Types of grounding systems include the following:

1. Electrical Service and Transformer Grounding
2. Building Grounding
3. Equipment Room Ground Terminal Bar
4. Electrical Equipment Grounding
5. Surge Protection Device (SPD) Grounding
6. Telecommunications Grounding
7. Equipotential Grounding Systems
8. Underground Distribution Grounding
9. Common Ground Bonding with Lightning Protection System

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions. etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in the NEC by Nationally Recognized Testing Laboratory (NRTL) and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

1.3 REQUIREMENTS

A. Grounding conductors, bonding conductors, jumpers, grounded conductors, etc. shall be sized in accordance with the NEC.

B. Equipment and materials shall be installed in accordance with the manufacturer's recommendations.

1.4 SUBMITTALS

A. Provide submittals for the following:

1. Ground rods and connectors.

2. Ground bars.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conductors:

1. Exposed grounding components such as bars, straps, cables, flexible jumpers, braids, shunts, etc., shall be bare copper unless otherwise indicated.

2. Grounding conductors in raceway with 600V circuiting shall be insulated to match the circuit conductors with green color.

3. Grounding conductors used with system voltage greater than 1000V shall be bare unless otherwise indicated.

4. Grounding conductor size shall be as indicated or as required by the NEC whichever is larger, stranded, soft drawn or soft annealed copper, unless otherwise indicated. Sizing shall take into account circuit voltage drop.

5. Acceptable Manufacturers:

a. Same make as for 600 volt conductors.

B. Ground Rods:

1. Provide solid copper or copper clad steel cylindrical rods, 3/4 in. minimum diameter and minimum 10 ft. long with pointed end. Provide units suitable for extension connection when ground rods longer than 10 ft. are indicated.

2. Acceptable Manufacturers:

a. Copperweld
b. Erico
c. Burndy
d. Approved equal.

C. Connectors, Clamps and Terminals:

1. Mechanical connectors and clamps shall be made of copper alloy or silicon bronze. Solderless compression terminals shall be copper, long-barrel, NEMA two bolt. Bolts and washers (Belleville) shall be of comparable material or stainless steel.

a. Acceptable Manufacturers:

1) Burndy
2) Hubbell Anderson Corp.
3) Thomas & Betts
4) Approved equal

2. Exothermic Welds:

a. Provide exothermic welds designed for size and type of intended cable, rods, structure, etc. Solder prohibited for connections, except for medium and high voltage cable metallic tape shields (utilize mechanical and solder).

b. Acceptable Manufacturers:

1) Erico "Cadweld"
2) Burndy "ThermOweld"
3) Approved equal

3. Pipe Clamp:

a. Pipe clamp for bonding to pipe type electrode (water pipe, etc.) shall be a suitably sized copper alloy clamp.

b. Acceptable Manufacturers:

1) Burndy GAR-BU
2) O-Z Gedney Type CG
3) Burndy "Durium"
4) AFL Global "Everdur"
5) Approved equal

4. Flexible Strap:

a. Flexible grounding straps shall be of braided high conductivity copper with two hole connector. Strap shall have equal to or greater than ampacity of the system it is bonding to. Strap shall provide flexibility in all directions when installed properly.

b. Acceptable Manufacturers:

1) Burndy
2) OZ Gedney

3) Approved equal

5. Electrostatic Floor Bonding:

a. Listed grounding kit for bonding ESD carpet, vinyl, rubber and epoxy floor coverings and coatings to ground with the following components:

1) 1 in. wide copper grounding tape.

2) Heavy gauge stainless steel ground termination plates with double sided conductive tape and 20 in. long lead wire with a #10 terminal ring at the end.

3) Acceptable Manufacturers:

a) Ground Zero Electrostatics Inc. "Zerostat" Floor Termination and Grounding Kits.

D. Ground Bars

1. Provide ground bars where indicated. Ground bars shall be:

a. 98% conductive copper, minimum.

b. 4 in. x 1/4 in. thick minimum with length as indicated with minimum 36 in. for electric room/MDF and all other minimum of 24 in.

c. Standard NEMA bolt hole patterns with maximum quantity of lug locations. Spacing of 1-1/8 in. apart.

2. Bar shall be mounted to an accessible wall location with galvanized steel hardware and 2000V rated insulators. Mounting shall be suitable for full complement of cabling.

3. Unit shall conform to EIA/TIA standards.

4. Acceptable Manufacturers:

a. Erico
b. Newton Instrument
c. Burndy
d. Harger

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding Conductors:

1. Provide grounding conductor(s) with all power circuits. Conductor shall be sized as indicated or as required by the NEC as a minimum and shall be terminated on the equipment, device, enclosure, etc. grounding terminal. Conductor size shall be for the entire length unless approved by the Engineer where oversized for voltage drop.

2. Conductors above grade to ground electrodes (water piping, structural column, etc.) and to equipment (service entrance, ground bars, ground halos, etc.) shall be installed in metallic conduit with ends bonded to the conduit.

3. Grounding conductors shall be installed to have a minimum radius of 3 in.

4. Grounding conductors in a raceway system shall be terminated/bonded to each box, cabinet, enclosure, etc. through which it passes or terminates.

5. Grounding conductors routed with underground circuits shall be bonded to each ground electrode and metallic cable support system within the raceway system including pull and access locations.

6. Stranded conductors penetrating vapor barriers, foundations, slab on grade and water stop membranes shall have the interstitial spaces between strands filled with solder 4 in. beyond the membrane each side. The conductor shall be sealed to the membrane with a manufacturer approved method.

B. Raceway Systems:

1. All metal supports, cable trays, messenger cables, frames, sleeves, brackets, braces, etc. for the raceway system, panels, switches, boxes, starters controls, etc., which are not rigidly secured to and in contact with the raceway system, or which are subject to vibration and loosening, shall be bonded to the raceway system.

2. Termination of rigid conduit at all boxes, cabinets, and enclosures shall be made up tightly with a double locknut arrangement and a bushing, bushings being of the insulated type. Utilize grounding bushings as specified elsewhere in these specifications.

3. Conduit which runs to or from boxes, cabinets, or enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and hence impair the continuity of system ground circuits shall be provided with bonding jumpers connected between a grounding type bushing/locknut on the conduit and a ground bus or stud inside the box, cabinet, or enclosure and attached thereto.

4. Conduit expansion joints and telescoping sections of metal raceways shall be provided with bonding jumpers sized in accordance with the NEC.

C. Ground Rods:

1. Ground rods shall be driven vertically the full length plus 24 in., minimum.

2. Ground rods shall be located in virgin soil or loamy compacted soil.

D. Connectors Clamps and Terminals:

1. Connectors utilized above grade in dry accessible locations shall be mechanical or exothermic type.

2. Connectors in damp locations, below grade or if not indicated shall be exothermic type.

3. Clean the area near the connecting surfaces prior to any connection to ensure effective contact. Cleaning shall be to the bare metal. Wire brush area if needed to remove rust scale paint, dirt, etc. to expose bare metal.

4. Exothermic connections shall be installed in accordance with the manufacturer's recommendations and tested with heavy blow of a five pound sledge.

E. Flexible Strap:

1. Flexible straps shall be used when bonding vibrating/moveable equipment, with expansion fittings and where recommended by the manufacturer.

2. Sufficient slack shall be provided to compensate for the anticipated vibration, movement and expansion.

F. Primary Electrical Equipment/Systems:

1. Transformers:

a. Primary voltages including those above 600 volts.

b. Provide a minimum of two #4/0 bare ground conductors from the transformer pad electrodes or building main ground bar to the transformer enclosure ground stud/pad/terminals.

c. Provide a #4/0 bare ground conductor from each lightning arrester to the transformer enclosure ground stud/pad/terminals.

d. For exterior pad mounted transformers, provide a bonding conductor sized in accordance with the NEC from the transformer neutral terminal to the ground stud/pad/terminals.

e. Connect system primary and secondary circuit grounding conductors to the transformer enclosure ground stud/pad/terminals.

2. Metal Enclosed/Metal Clad Switchgear:

   a. Equipment includes metal enclosed/metal clad switch units, switch and fuse units, auxiliary units, metering units, air circuit breaker units, etc. these shall be effectively grounded in accordance with requirements described herein and the manufacturers recommendations.

   b. Provide two (2) #4/0 ground conductors from the equipment ground bus to the ground bar or one (1) #4/0 ground conductor from the equipment ground bus to the building ground bar for every two (2) compartments in a continuous line-up equipment, whichever is the greater number.

   c. Connect system circuit grounding conductors to the equipment ground bus.

3. Cabling:

   a. All medium and high voltage cable shielding shall be bonded to the local ground system in all buildings, switchgear, transformers, manholes containing splicing/connectors, etc. Suitable terminations, connectors, splices, etc. should be used to expose the cable shield for grounding.

   b. The grounding conductors contained in the interstices of interlocked armor cable shall be connected to the ground bus at every equipment termination point and to each other and to system ground; ground at every splice location.

   c. The grounding conductor contained in raceway systems shall be connected to the ground bus at every equipment termination point and to each other and to system ground; ground at every splice location.

G. Secondary Electrical Systems:

1. The neutral (grounded) conductor of each low voltage, single and/or polyphase system or distribution system, except special isolated double insulated systems, shall be solidly connected to ground at the transformer neutral bushing, or at the main secondary switchgear to the system ground, and shall be sized for current carrying capacity, not to be less than as required by the NEC. Ground connection shall be to the building grounding system, building steel, building water service, building concrete reinforcement and as indicated.

2. Provide equipment grounding conductor, green colored insulation, with phase conductors, to primary side of all transformers rated 600 volts or less circuited to the enclosure and secondary neutral bushing, to all electrical utilization and distribution equipment; insulation shall be same type as phase conductors. Transformer enclosures shall be bonded to the primary and secondary circuit grounding conductor.

3. Equipment grounding conductors shall extend from the point of termination back to the ground bus of the source panelboard, switchboard, transformer, or switchgear.

H. Equipment Grounding:

1. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch circuit conductors.

2. Surge Protection Device (SPD) Ground Conductor Installations: Extend SPD dissipation ground conductors to local equipment ground bus and to common grounding electrode conductors. Size conductors per SPD manufacturer recommendations and the NEC.

I. Communications Rooms:

1. For each building communications room or closet provide one (1) wall mounted ground bar bonded to the main building ground bar or electrical service ground with insulated #4/0 AWG conductor.

2. Local cable trays, equipment racks, etc. shall be bonded to the ground bar with insulated #6AWG minimum.

J. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors in conduit from building's main service equipment or grounding bus to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a bolted clamp connector or by bolting a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

K. Underground Distribution:

1. Manholes and Handholes: Provide a driven ground rod through opening in the floor/bottom with 4 in. exposed. If necessary due to the site conditions, install the ground rod prior to manhole/handhole installation and provide a #1/0AWG bare conductor from the ground rod with an exothermic connection in the manhole/handhole. Seal the opening with waterproof nonshrinking grout.

2. Bond exposed parts within manhole/handhole such as inserts, pulling rings, cable racks, ladders and cable shields to the ground rod with #2AWG bare conductor minimum. Conductors shall be neatly installed around the perimeter of the unit and support 3 ft. on center with non-corrosive support and hardware.

3.2 GROUND TERMINAL BUS INSTALLATION

A. Install ground terminal bar in rooms where shown on the drawings. Mount bar 18 in. above finished floor by anchors and bolts using 1-1/2 in. long insulated spacer between bar and wall. Use a minimum of two (2) supports 18 in. on center. Connect all grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar.

B. Label grounding conductors terminated to bus for equipment, location, electrode, etc served.

3.3 TESTS

A. Test the building ground system before backfilling to ensure continuity and determine system resistance value.

B. Testing procedure shall be a fall of potential type with a moving auxiliary electrode in accordance with IEEE Standard 142 and reviewed/approved by the Engineer. Sufficient test points shall be taken for accurate resistance value.

C. Make resistance measurements in dry weather, no earlier than 48 hours after rainfall. Provide tabulated test results indicating distance between rods and resistance readings on a plotted graph.

D. Test each ground electrode system separately prior to connection to the system or main building ground bar. Test each system ground electrode system a second time after backfilling has occurred and all final connections (building steel, water service, etc.) have been made.

E. Soil type, date, time, meter manufacturer/model number, person performing the test, test witnesses and most recent rainfall shall be noted in test submittal.

END OF SECTION

SECTION 260800

COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

B. The OPR and BOD documentation are included by reference for information only.

C. Division 01 section ‘LEED Requirements’ for additional LEED requirements.

1.2 SUMMARY

A. This section includes commissioning process requirements for Electrical systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

A. Refer to Division 01 Section “General Commissioning Requirements” for the description of commissioning.

1.4 DEFINITIONS

A. Refer to Division 01 Section “General Commissioning Requirements” for definitions.

1.5 SUBMITTALS

A. Refer to Division 01 Section “General Commissioning Requirements” for CxA’s role.

B. Refer to Division 01 Section “Submittals” for specific requirements. In addition, provide the following:

C. Certificates of readiness

D. Certificates of completion of installation, prestart, and startup activities.

E. O&M manuals

F. Test reports

1.6 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.

1.7 COORDINATION

A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - 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 electrical contractor of Division 26 shall ultimately be responsible for all standard testing equipment for the electrical systems and controls systems in Division 26. A sufficient quantity of two-way radios shall be provided by each contractor.

B. Special equipment, tools and instruments (specific to a piece of equipment and only available from 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.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems

B. 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 made available to the Commissioning Team for use prior to the start of 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.

C. 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 mad by the Contractor.

D. 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 four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meetings.

C. Participate in Electrical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CA.

D. Provide information requested by the CxA for final commissioning documentation.

E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

F. Prepare preliminary schedule for Electrical system orientations and inspections, operation and maintenance manual submissions, training sessions, equipment start-upand task completion for owner. Distribute preliminary schedule to commissioning team members.

G. Update schedule as required throughout the construction period.

H. Assist the CxA in all verification and functional performance tests.

I. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

J. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.

K. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

L. Notify the CxA a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.

M. Participate in, and schedule vendors and contractors to participate in the training sessions.

N. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
1. Electrical equipment including switchgear, panel boards, motor control centers, lighting, receptacles, dimmers and all other equipment furnished under this Division.
2. Emergency generators, ATS switches and emergency power systems.
3. Fire alarm system

O. The equipment supplier shall document the performance of his equipment.

P. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.

Q. Equipment Suppliers
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 contractors.
3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

R. Refer to Division 01 Section “General Commissioning Requirements” for additional Contractor responsibilities.

3.3 OWNER’S RESPONSIBILITIES

A. Refer to Division 01 Section “General Commissioning Requirements” for Owner’s Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Refer to Division 01 Section “General Commissioning Requirements” for Design Professional’s Responsibilities.

3.5 CxA'S RESPONSIBILITIES

A. Refer to Division 01 Section “General Commissioning Requirements” for CxA’s Responsibilities.

3.6 TESTING PREPARATION

A. Certify in writing to the CxA that Electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the CxA that Electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.7 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Electrical testing shall include the entire Electrical installation, from the incoming power equipment throughout the distribution system. Testing shall include measuring, but not limited to resistance, voltage, and amperage of system(s) and devices.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the Electrical contractor and other contracted subcontractors, including the fire alarm Subcontractor shall prepare detailed testing plans, procedures, and checklists for Electrical systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.8 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 26 sections. Provide submittals, test data, inspector record, infrared camera and certifications to the CA.

B. Electrical Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 26 Sections "Instrumentation and Control" and "Sequence of Operations" Assist the CxA with preparation of testing plans.

C. Emergency Generator Testing and Acceptance Procedures: Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

D. Fire Detection and Alarm System Testing: Provide technicians, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Electrical Distribution System Testing: Provide technicians, load banks, infrared cameras, instrumentation, tools and equipment to test performance of designated systems and devices at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested

F. Vibration and Sound Tests**:** Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

G. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

1. Electrical Distribution
2. Lighting Controls
3. Emergency Lighting 90 minute test

3.9 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.10 APPROVAL

A. Refer to Division 01 Section “General Commissioning Requirements” for approval procedures.

3.11 DEFERRED TESTING

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.12 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.

B. Refer to Division 01 Section “General Commissioning Requirements” for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.13 TRAINING OF OWNER PERSONNEL

A. Refer to Division 01 Section “General Commissioning Requirements” for requirements pertaining to training.

END OF SECTION 230800

ELECTRIC DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a complete distribution system as indicated on the Contract Documents and as specified herein.

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

1.3 SUBMITTALS

A. Submit the following product data/information:

1. Manufacturer and equipment type.

2. Standard catalog information sheet.

3. Detailed shop drawings indicating plan, elevation, end and isometric views. Top and bottom conduit areas shall be clearly shown and dimensioned on the drawings.

4. Single-line diagram.

5. Complete Bill of Materials.

6. All relevant ratings including, but not limited to, voltage, current, interrupting and withstand.

7. Overcurrent Device Information. Model number, available settings, setting ranges, capabilities, etc.

8. Submit available and final settings, programming and adjustments.

B. Submit product data and information for the following equipment, materials, products, etc.:

1. Dry type transformer(s) including shielded and linear load transformer(s).

2. Distribution and branch circuit panelboards.

3. Enclosed circuit breakers.

4. Disconnect switches.

5. Surge Protective Devices.

1.4 WARRANTY

A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 and a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Dry-Type Transformers:

1. Transformers to be factory-assembled and tested, air-cooled ventilated units for 60 Hz service. Transformers that require internal or external fan assisted forced air cooling to obtain ambient air (AA) rated kVA are not acceptable. Transformers 15 kVA and less shall have 185°C insulation system and shall be designed not-to-exceed 115°C rise above 40°C ambient. Transformers 30 kVA and higher shall have 220°C insulation system and shall be designed not-to-exceed 115°C rise above 40°C ambient. Insulation systems shall be U.L. listed. Cores shall be manufactured from a high-grade, non-aging, silicon steel with high magnetic permeability, low hysteresis and eddy current losses, one leg per phase, and grounded to enclosure. Cores shall be clamped with structural angles and bolted to the enclosure to prevent damage during shipment or rough handling. Remove clamping after installation. Coils shall be continuous winding except for taps, copper, vacuum impregnated with non-hydroscopic thermosetting varnish and shall have a final wrap of electrical insulating material designed to prevent injury to the magnet wire. Transformers having coils with magnet wire visible will not be acceptable. 30 KVA, and larger, floor mounted. Under 30 KVA, wall mounted. Provide Mason type ND, Korfund or Vibrex vibration isolation devices for each transformer. Provide ground bar kit or a ground bar installed on the inside of the transformer enclosure.

2. Ratings: Shall be as indicated on the “Transformer Schedule” or as noted on the drawings. IEEE #C57, NEMA and US Government requirements shall apply. The transformer efficiencies shall meet or exceed the requirements of New York State and the US Department of Energy.

3. For transformers up to 300 kVA, provide with 6-2-1/2% full capacity taps, 2-FCAN (for connections above nameplate) and 4-FCBN (for connections below nameplate). For transformers above 300 kVA, provide 4-2-1/2% fully rated taps, 2-FCAN and 2-FCBN.

4. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:

   a. Square D
   b. Eaton Corporation
   c. ABB

B. Buck Boost Transformer:

1. Self-cooled, two winding dry-type, rated for continuous duty, 60 Hz, single phase units, connected in field with wiring terminals suitable for connection as autotransformer. Standard impedance of 2 to 5 percent up to 10 kVA, 220°C insulation system and shall be designed not-to-exceed 80°C rise above 40°C ambient. Cores shall be manufactured from a high-grade, non-aging, silicon steel with high magnetic permeability, low hysteresis and eddy current losses, and grounded to enclosure with a flexible copper grounding strap. Coils shall be continuous winding, aluminum, vacuum impregnated with non-hydroscopic thermosetting varnish. Transformer coils shall terminate in mounting pads

2. Electrical Characteristics:

   a. Refer to drawings, schedules, and wiring diagrams.

3. Acceptable Manufacturers: Same as Dry-Type Transformers.

2.2 MATERIALS

A. Distribution Panelboards (Nominal 600 Volt):

1. Provide distribution panelboards as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal magnetic, molded case circuit breakers as scheduled.

2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure, main lugs, and main breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50°C rise above ambient.

3. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF". Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.

4. Each panelboard, as a complete unit shall have a short circuit rating equal to or greater than the rating shown on the Panelboard Schedule. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. The use of series rating of panelboards for short circuit rating is not acceptable.

5. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets shall be equipped with locks and all locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge, full-finished steel with rust-inhibiting primer and baked enamel finish.

6. The panelboard interior assembly shall be dead front with panelboard front removed. Panelboard front shall be door in door construction with full length piano-hinge. Main lugs or main breakers shall be barriered on five (5) sides. The end of the bus structure opposite the mains shall be barriered.

7. Panelboards shall be UL listed for use intended.

8. Ratings shall be as indicated in the contract documents.

9. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:

   a. Square D "I-Line" - Design Make.
   b. Eaton Corporation "PRL3"
   c. General Electric by ABB

B. Branch Circuit Panelboards (480Y/277 volt, 208Y/120 volt):

1. Provide branch circuit panelboard as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal-magnetic, molded case circuit breakers as scheduled.

2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67.

3. Provisions for additional circuit breakers shall be such that field addition of connectors or mounting hardware will not be required to add circuit breakers to the panelboard. Bus connections shall be bolt-on.

4. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the rating shown on the Panelboard Schedule or on the plans. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. Reducing breaker ratings on the basis of series rating is not acceptable.

5. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be specified in UL Standard 50 cabinets.

Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. Each front shall include a door and have a flush, stainless steel, cylinder type lock with catch and spring-loaded door pull. All panelboard locks shall be keyed alike. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge, full-finished steel with rust inhibiting iron phosphate sealer and baked enamel finish. Minimum box width shall be 20 in. Provide door-in-door construction. Panelboard to be keyed to match the Owner's existing system.

6. Ratings shall be as indicted on the Panelboard Schedule.

7. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

   a. 480Y/277 Volt:

      1) Square D "NF" - Design Make.
      2) Eaton Corporation "PRL2"
      3) General Electric by ABB

   b. 208Y/120 Volt:

      1) Square D "NQ" - Design Make.
      2) Eaton Corporation "PRL1"
      3) General Electric by ABB

C. Circuit Breakers:

1. Circuit breakers below 200 amp frame shall be molded case constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

2. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes. Single pole 15 and 20 ampere circuit breakers shall be UL listed as “Switching Breakers” at 120V ac or 277 V ac and carry the SWD marking. Lugs shall be mechanical, rated for 60/75° AL/Cu.

3. Thermal Magnetic Circuit Breakers: Inverse time current element for low level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit breaker frame sizes 250A and larger.

4. Adjustable, Instantaneous Trip Circuit Breakers – Magnetic trip element with front mounted, field adjustable trip setting.

5. Electronic Trip Circuit Breakers (400A frame and above and where indicated on drawings): 100% rated, RMS sensing, field replaceable rating plug or electronic trip, digital display of settings, trip targets, and indicated metering displays with multi-button keypad and ten-event, trip history log, and front field adjustable settings for long time, long time delay, short time, short time delay, instantaneous trip, ground fault, zone interlock for ground fault and short trip, programmable with handheld unit as indicated. Ability to turn instantaneous off.

    a. Square D Micrologic trip unit - Design Make.

    b. Eaton Corporation Optim 550 trip units for circuit breakers 400 – 1600 amp frame or RMS 610 trip units for 2000 amp frame to 6000 amp frame.

    c. ABB Spectra RMS or MicroVersa trip unit.

    d. Provide a test set for each type of solid state trip unit.

6. Shunt Trip: 120V trip coil energized from separate circuit, with coil-clearing contact.

7. Key Interlock Kit: Externally mounted to prohibit circuit breaker operation; keying shall follow sequence indicated on drawings.

8. Handle Padlocking Device: Fixed attachment, for locking circuit breaker in on or off position.

9. Ground-Fault Circuit Interrupter (GFCI) circuit breakers shall be quick-make, quick-break, thermal-magnetic, Class A, 6 milliampere ground fault sensing and trip indicating, and multipole breakers shall have common trip. The ground fault circuit breakers shall not occupy any more space than a standard breaker of the same number of poles.

10. Ground Fault Equipment Protector (GFEP) circuit breakers shall be utilized for electric heating equipment and where indicated. These shall be quick-make, quick-break, thermal-magnetic, Class B, 30 milliampere ground fault sensing and trip indicating, and multipole breakers shall have common trip. The ground fault circuit breakers shall not occupy any more space than a standard breaker of the same number of poles.

11. Arc-Fault Circuit Interrupter (AFCI) circuit breakers shall be quick-make, quick-break, thermal-magnetic, and trip indicating, and multipole breakers shall have common trip. Sensor shall recognize the unique current or voltage signatures associated with arcing faults and efficiently interrupt the circuit to reduce fire hazards. Sensor shall detect persistent low current arcing faults down to 5 amps with associated mitigation of fire hazards in the cords connected to the outlets.

12. Dual Function Circuit Breakers shall provide both GFCI and AFCI protection. Circuit breaker shall have the same electrical requirements as the individual devices listed above.

13. Arc Flash Energy Mitigation: Provide the following arc flash energy mitigation system for all circuit breakers 1200A and larger.

    a. Arc Energy Reduction Maintenance Switch: Equipment main circuit breaker shall have a selector switch in the front of the unit enclosure and another remotely mounted at the entrance to the room for maintenance periods. The switch shall be 30mm metal Square D type K and labeled "Normal" and "Maintenance". The normal position shall utilize the standard trip settings of the breaker. The maintenance position shall utilize a quicker series of trip settings to reduce the potential arcing energy. The selector switch shall have a protective flip up cover. LED warning light on the face of the unit enclosure shall indicate when in the maintenance mode and have appropriate signage. The system shall be fully wired and tested by a factory authorized/trained technician.

14. Listed combination of coordinated circuit breakers shall be verified by the equipment manufacturer utilizing published data sheets. Confirmation listings shall be submitted.

15. Ratings shall be as indicated in the Contract Documents.

16. Enclosed circuit breakers shall be molded case, thermal-magnetic type, ratings as noted, with overcenter, trip-free, toggle-type operating mechanism, quick make/quick break action and positive handle indication. Multiple pole breakers shall be common trip type. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each phase. Provide provisions for padlocking in the "off" position. Breakers shall be calibrated for operation in an ambient temperature of 40°C and shall be suitable for mounting and operating in any position. Breakers shall have removable lugs, UL listed for copper and aluminum conductors. Breakers shall be installed in NEMA 1 general purpose, surface enclosures, unless otherwise noted. UL listed as suitable for use as service equipment.

    a. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

        1) Square D
        2) Eaton Corporation
        3) ABB

D. Power Meter:

1. Where indicated on the drawings, provide a factory installed unit mounted power meter with the following parameters:

    a. LCD or LED display.

    b. Line voltage control power.

    c. Voltage input with overcurrent protection and disconnecting means.

    d. True RMS voltage and current measurement.

e. Metered parameters: Phase current, line voltage, phase voltage, frequency, power factor per phase and three phase total, real power per phase and total, reactive power per phase and total, apparent power per phase and total, total real energy, total reactive energy, total apparent energy, user configured sliding window for real, reactive and apparent power peak demand. Sampling rate shall be 512 sample points per cycle minimum. Waveform capture with adjustable triggers.

f. Accuracy: Energy, and demand power: 0.2% in accordance with ANSI C12.20Instrument current transformers shall be factory wired to shorting blocks to prevent open-circuiting the current transformers under energized conditions. The meter shall also be user programmable for current to any CT ratio.

g. Capable of metering up to 480 volts without external potential transformers. The meter shall also be user programmable for voltage range to any PT ratio.

h. Communications: Modbus RTU, TC/IP, etc.

i. Acceptable Manufacturers:

1) Equipment (Unit Manufacturer)
2) Square D
3) Eaton Corporation
4) Shark

E. Disconnect Switches:

1. Shall be heavy-duty type three-pole, with "Quick Make/Quick Break" operating handle mechanically interlocked with the cover, horsepower and voltage rated to match equipment served. Where indicated switches shall be provided with dual-element, time delay, rejection type fuses. Switches shall be installed in NEMA 1 for indoor use, NEMA 4X for outdoor use. Provide provisions for padlocking in the "off" position. Provide neutral bar in single phase or three phase, four wire circuits, and ground bar in all switches. Provide auxiliary contacts where called for.

2. All disconnects connected downstream of ASD's shall have a normally open and normally closed auxiliary contacts which shall be wired to the ASD to indicate disconnect is open.

3. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

a. Square-D - Design Make.
b. Cutler Hammer.
c. General Electric by ABB

F. Fuses:

1. All fuses rated 600 volts and below shall be rejection type dual-element, time-delay type. Provide two (2) complete sets of fuses for all fusible devices. Deliver spare fuses to the Owner and obtain receipt.

2. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

   a. Fuses 600 Amperes and Below: Bussman Type FRS-R (600 volts), Bussman Type FRN-R (300 volts) or equivalent.

   b. Fuses Rated Above 600 Amperes: Bussman Type KRP-C or equivalent.

G. Surge Protective Device:

1. Device shall be rated for location as shown on drawings.

2. Seven Mode Protection: Line-to-neutral (three), line-to-ground (three) and neutral-to-ground.

3. Provide test report from a recognized independent testing laboratory verifying the Surge Protective Devices (SPD) can survive published surge current rating on both a per mode and per phase basis. ANSI/UL 1449, latest edition.

4. Surge Current Capacity – The minimum total surge current tested with the ANSI/IEEE C42.41, 20 kA-8/20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

	Application	Peak Surge Current Per Phase	Nominal Discharge Current – In Per Mode
a.	Type 1 – Before Service Entrance	250 kA	20 kA
b.	Type 2 – After Service Entrance	160 kA	20 kA

5. Unit shall comply with ANSI/UL-1449, latest edition. Voltage Protection Rating (VPR) per Mode must not exceed the following for Type 1 SPD:

   a. 208Y/120, L-N 700 volts, L-G 700 volts, N-G 800 volts, L-L 1000 volts.

   b. 480Y/277, L-N 1200 volts, L-G 1200 volts, N-G 1200 volts, L-L 2000 volts.

6. Unit shall comply with ANSI/UL-1449, latest edition. Voltage Protection Rating (VPR) per Mode must not exceed the following for Type 2 SPD:

   a. 208Y/120, L-N 800 volts, L-G 700 volts, N-G 800 volts, L-L 1000 volts.

b. 480Y/277, L-N 1000 volts, L-G 1200 volts, N-G 900 volts, L-L 1800 volts.

7. UL-1283 bi-directional high frequency noise attenuation for electric line noise shall be 50 dB at 10 kHz-100 MHz.

8. Short Circuit Current Rating: 200 KAIC.

9. Indication system:

a. A green/red LED indicator for each phase.
b. Flashing trouble light.
c. Shall alarm open circuit damage, thermal conditions and overcurrent.

10. Transient surge counter.

1) Provide dry contact for remote monitoring.

11. External mounted model.

12. Manufacturers:

a. Square D
b. Eaton Corporation.
c. L.E.A./Dynatech.
d. Vertiv
e. Current Technology

2.3 SHORT CIRCUIT PROTECTION, COORDINATION AND ARC FLASH STUDY

A. The contractor shall provide an electrical power systems study as described below and submitted for approval prior to final equipment submission. Submit documents/drawings of complete short circuit, coordination and arc flash study for the electric distribution system for this project including the service entrance to all branch circuit panelboards and branch circuits 50A and over. Documents shall be prepared by a licensed Professional Engineer in New York State with at least 5 years' experience in similar studies, using the most current software version of SKM Power Tools. Study documentation shall include:

1. Software used to prepare study with a description of the software philosophy.

2. Quantities, ratings and characteristics of all system components.

3. Impedance data for each piece of equipment.

4. Calculation methods and tabulations.

5. One-line diagrams and impedance diagrams.

6. Service entrance characteristics (available short circuit, X/R ratio, voltage, etc).

7. Available short circuit at each node in the system with associated required equipment ratings.

8. Coordination verification with equipment settings and time current graphs.

9. Arc flash energy level at each piece of equipment with adhesive labels.

10. Conclusions and recommendations.

B. Short Circuit Current:

1. Perform short circuit current calculations to determine the available short circuit current at each piece of distribution equipment.

2. Calculations shall take into account the following:

a. Available utility short circuit current.

b. System impedances (transformers, conductors, etc.).

c. Conduit types.

d. Motor contribution for motors.

C. Coordination:

1. Electrical distribution system shall be fully coordinated from the service entrance to branch circuit over current protection.

2. Emergency electric distribution system shall be fully coordinated from the service entrance to the branch circuit over current protection.

3. The coordination shall meet the current edition of ANSI/IEEE Standard 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems. The study shall indicate that this standard was used as the basis for the study.

4. Field settings, adjustments and minor modifications necessary for conformance with the recommendations shall be accomplished without additional expense to Owner. Provide documentation that all applicable over current protective devices have the recommended settings and have been suitably calibrated.

5. Coordination graphs shall indicate coordination proposed for systems indicated on log-log graph forms. Coordination graphs shall include:

a. Complete descriptive titles.

b. Graph for all over current devices.

c. Thermal damage curves (conductors, transformers, etc.), available short circuit current limits, rated current levels and over current protective device operation bands. Over current protective device operation bands shall be for the recommended settings.

d. Indication that applicable devices are inherently selectively coordinated with associated back up list from the manufacturer.

e. Listing of all project over current devices with manufacturer and model number.

f. Recommended settings for all adjustable over current protective devices.

6. Equipment design discrepancies and proposed corrective modifications if required shall be submitted with studies with variations clearly note.

D. Arc Flash:

1. Arc flash evaluation shall be provided to determine the arc flash energy at each piece of distribution equipment. Calculation shall be in accordance with IEEE 1584 and NFPA 70E.

2. Two separate arc flash energy levels shall be calculated and displayed on separate labels in locations that an arc flash energy reduction maintenance switch is utilized to indicate the energy with and without the switch engaged.

3. Arc flash calculations shall utilize finalized and approved over current protective device settings.

4. Arc Flash labels shall be furnished and installed on the appropriate equipment after the Short Circuit, Coordination and Arc Flash Study has been completed and approved. Layout and information on the label shall be approved by the engineer of record.

E. Once competed and approved, provide the Owner and Engineer an electronic copy of the full calculations, inputs and outputs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be grounded per the NEC.

B. Electrical distribution equipment shall have lugs/terminations suitable for the indicated conductor size. Where conductors have been oversized for voltage drop and where approved by the Engineer it shall be allowed to reduce the conductor size using hydraulically crimpled splice in a box next to the distribution equipment to allow for standard lug termination.

C. Install dry-type transformers with adequate clearances for proper ventilation. Bolt floor mounted transformer to pad.

D. Distribution switchboards, motor control centers and floor mounted dry-type transformers shall be mounted on 4 in. high concrete pads which shall extend 3 in. on all sides. Securely bolt the unit to the pads for proper horizontal and vertical alignment.

E. Coordinate transformer pad dimensions with transformer manufacturer's requirements. Coordinate transformer pad locations, dimensions and details with General Contractor.

F. Provide pad lockable branch circuit breaker device to hold circuit breaker in the closed position, but not prevent overcurrent protection, for all branch circuits serving fire alarm controls panels, emergency lighting and life safety branch circuits.

G. Identification:

1. Identify all items of equipment as described in Section 260501-3.1, Identification. Identification shall be provided for switchboards, panelboards, transformers, ASD's, motor starters, disconnect switches, enclosed circuit breakers, switchboard main/distribution breakers, MCC's automatic transfer switches, UPS's, generators, surge suppression devices, control panels, switchgear, etc.

2. Switchboards, panelboards, MCC's, switchgear, etc. shall have a label indicating name/tag ID, feeder source, conductor color convention and for service entrance locations the available short circuit current.

3.2 ELECTRICAL LOAD TEST

A. Conduct a load test prior to request for final payment and comply with the following:

1. Energize maximum normal light and power load for a period of two hours when scheduled.

2. Record voltage at service and at each panel.

3. Measure current in each phase of all feeders.

4. Adjust transformer taps as directed by engineer after review of report.

5. Provide and install all necessary metering equipment.

6. Owner's Representative or Site Representative shall witness the test.

7. Before final acceptance specified test shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such tests and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Protective equipment shall be actuated in a manner that clearly demonstrated their workability and operation.

3.3 CLEANING

A. At the completion of the project, while equipment is de-energized, it shall be thoroughly cleaned to a shipped condition using methods in accordance with the manufacturer's recommendations. Utilize vacuum for cleaning and not compressed gas.

3.4 SPARE PARTS

A. Deliver loose equipment to the Owner and obtain receipt for fuses, keys to panelboards, etc.

3.5 DISCONNECT DEVICES

A. All disconnect devices downstream of ASD's: Provide wiring, conduit and connections between ASD and disconnect auxiliary switch to ASD.

END OF SECTION

MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, equipment and services as required for the complete installation and full operation of separately enclosed, preassembled, motor controls, rated 600V and less.

1.2 DEFINITIONS

A. ASD: Adjustable speed drive motor controller.

B. CPT: Control power transformer.

C. DDC: Direct digital control. Building management/control system.

D. EMI: Electromagnetic interference.

E. PWM: Pulse width modulated.

F. RFI: Radio-frequency interference.

1.3 SUBMITTALS

A. Submit manufacturer's product data for each type and rating of motor controller indicated.

1. Include dimensions, weights, enclosure types, rating capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, mounting and attachment details, method of field assembly, components, and location / size of each field connection.

2. Include diagrams for power, signal, and control wiring.

B. As part of Operation and Maintenance Data, provide manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules, setting field-adjustable timers, controls, and status and alarm points, and setting field-adjustable overload relays.

1.4 QUALITY ASSURANCE

A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers.
Where "or equal" is stated, equipment shall be equivalent in every way to that of the

equipment specified and subject to approval.
All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with the manufacturer's recommendations, NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

D. Equipment and systems shall be NRTL tested and labeled.

1.5 WARRANTY

A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 with a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers include:

B. Adjustable Speed Drives (ASDs):

1. ABB (Design Make - ACH580)

2. Yaskawa

3. Eaton Corporation

C. Manual and Magnetic Motor Controllers:

1. Square-D - Design Make

2. Cutler Hammer

3. General Electric

4. Allen-Bradley

2.2 ADJUSTABLE SPEED DRIVE MOTOR CONTROLLER

A. General Requirements for ASDs:

1. ASD Description: adjustable speed drive, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; arranged to provide self-protection, motor protection, and variable-speed control of one or more induction motors by adjusting output voltage and frequency. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508. Suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1.

B. Unit Operating Requirements:

1. ASD shall provide full rated output from a line voltage of plus 10% and minus 10% of nominal voltage. ASD shall continue to operate without faulting from a +30% to -35% of nominal line voltage.

2. Input AC Voltage Unbalance: Not exceeding 5 percent.

3. Input Frequency Tolerance: Plus or minus 5 percent of ASD frequency rating.

4. Minimum Efficiency: 98 percent at 60 Hz, full load.

5. Minimum Primary-Side Power Factor: 98 percent under any load or speed condition.

6. Minimum Short-Circuit Current (Withstand) Rating: 100kA.

7. Ambient Operating Temperature Rating: 5 deg F (-15 deg C) to 104 deg F (40 deg C) minimum.

8. Humidity Rating: To 95 percent (noncondensing) minimum.

9. Altitude Rating: Suitable for intended location with 3300 feet minimum.

10. Vibration Withstand: Comply with NEMA ICS 61800-2.

11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.3 times the base load current for two seconds.

12. Starting Torque: Minimum 140 percent of rated torque from 3 to 60 Hz.

13. Output Carrier Frequency: Selectable; 1 to 12.5 kHz.

14. Stop Modes: Programmable including fast, free-wheel, and dc injection braking.

C. Inverter: ASD shall employ a 6 PWM power electronic system, consisting of:

1. Input Section:

a. ASD input power stage shall convert three-phase AC line power into a fixed DC voltage via a solid state full wave diode rectifier.

2. Intermediate Section:

a. DC bus as a supply to the ASD output Section shall maintain a fixed voltage with filtering and short circuit protection.

b. DC bus shall be interfaced with the ASD diagnostic logic circuit, for continuous monitoring and protection of the power components.

3. Output Section:

a. Insulated Gate Bipolar Transistors (IGBTs) shall convert DC bus voltage to variable frequency and voltage.

b. The ASD shall employ pulse width modulated output technology to power the motor.

D. Isolated Control Interface: ASDs control input to follow remote-control signal (selectable 0-10VDC, 4-20mA, 0-20mA, and network) over a minimum 40:1 speed range with electrical signal.

E. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.

2. Maximum Speed: 80 to 100 percent of maximum rpm.

3. Acceleration: 0.1 to 6000 seconds.

4. Deceleration: 0.1 to 6000 seconds.

5. Current Limit: 30 to minimum of 150 percent of maximum rating.

F. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the ASD, complying with UL 1449 SPD, Type 1 or Type 2.

2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

3. Under and overvoltage protection.

4. Inverter overcurrent protection.

5. ASD and Motor-Overload/Over temperature Protection: Microprocessor-based thermal protection system for monitoring ASDs and motor thermal characteristics, and for providing ASD over temperature and motor-overload alarm and trip. The settings shall be selectable utilizing the keypad.

6. Critical frequency rejection, with three selectable, adjustable dead bands.

7. Instantaneous line-to-line and line-to-ground overcurrent trips.

8. Loss-of-phase protection.

9. Reverse-phase protection.

10. Short-circuit protection.

11. Motor over-temperature fault.

12. Shut down on indication of motor local disconnect switch open position.

G. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts. Field adjustable for manual restart.

H. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

I. Bidirectional Autospeed Search: Capable of starting ASD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

J. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

K. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

L. Integral Input Disconnecting Means: magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

M. The ASD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.

N. The ASD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via keypad warning, Form-C relay output, or over serial communication bus.

O. Unit Mounted Operator Station: front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service. Coordinate the access codes with the Owner.

P. Status indicators displaying the following conditions:

1. Power on.

2. Run.

3. Overvoltage.

4. Line fault.

5. Overcurrent.

6. External fault.

Q. Indicating Devices: Digital display mounted flush in ASD door and connected to display ASD parameters including, but not limited to:

1. Output frequency (Hz).

2. Motor speed (rpm).

3. Motor status (running, stop, fault).

4. Motor current (amperes).

5. Motor torque (percent).

6. Fault or alarming status (code).

7. PID feedback signal (percent).

8. DC-link voltage (V dc).

9. Set point frequency (Hz).

10. Motor output voltage (V ac).

R. Control Signal Interfaces:

1. Electric Input Signal Interface:

a. A minimum of two programmable analog inputs field selectable for 0- to 10-V dc or 4- to 20-mA dc.

b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:

a. 0- to 10-V dc.

b. 4- to 20-mA dc.

c. Potentiometer using up/down digital inputs.

d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of one programmable analog output signal (0- to 10-V dc or 4- to 20-mA dc), which can be configured for any of the following:

a. Output frequency (Hz).

b. Output current (load).

c. DC-link voltage (V dc).

d. Motor torque (percent).

e. Motor speed (rpm).

f. Set point frequency (Hz).

g. Any aux contacts.

4. Remote Indication Interface: A minimum of three programmable dry-circuit relay outputs (120-VAC, 1 A) for remote indication of the following:

a. Motor running.

b. Set point speed reached.

c. Fault and warning indication (overtemperature or overcurrent).

S. Interface with DDC System for HVAC: Factory-installed hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports.

ASD settings shall be retained within ASD's nonvolatile memory.

1. Provide EIA-485 port as standard. The standard protocols shall be BACnet MS/TP, Modbus RTU and N2. Provide additional ports for any other protocols that are utilized in the project.

T. Interface so ASD has indication of downstream disconnect switch(es) status (open-closed) and operates accordingly.

U. ASDs shall have an input inductive reactance either via 5% impedance AC line reactor or a pair of balanced DC chokes, one on the positive and one on the negative side of the DC bus, with an effective input impedance equivalent to a 5% AC line reactor. Any ASDs that do not meet this requirement must have a 5% AC line reactor added, with the reactor mounted in the same enclosure as the ASD.

V. EMI/RFI Filtering: Onboard filters shall allow ASD assembly to be CE marked; certify compliance with IEC 61800-3 for Category C2.

W. Additional Features:

1. Remote digital operator kit.

2. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

X. Accessories:

1. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in ASD enclosure cover unless otherwise indicated.

2. Reversible NC/NO bypass contactor auxiliary contact(s).

3. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

2.3 MOTOR STARTERS

A. Provide motor starters as listed on the Electric Equipment and Control Schedule on the drawings.

B. Starters, contactors and controllers shall comply with NEMA standards having general purpose NEMA 1 or 1B enclosure unless otherwise called for. Provide explosion proof, weather resistant or watertight construction as required. Starters shall be minimum NEMA size 0 with solid state overloads in each phase sized per NEC, motor full load amperage, service factor, and motor operating conditions.

C. Pad lock arrangements shall be provided to lock the disconnect device in the "off" position. Magnetic starters shall be provided with a control power transformer with 120V secondary and primary and secondary fusing and be sized to accept the loads imposed there on. Starters shall have LED type pilot lights. Each starter subject to electrical interlock and/or automatic control shall have necessary auxiliary contacts.

D. Auxiliary Devices: Provide pushbutton stations, pilot lights, devices, relays, transformers, selector switches, electric thermostats, auxiliary starter contacts as required for functions called for. Provide separate relay for each speed to operate electric dampers or other devices as required for multispeed motor circuit.

E. Manual Motor Starter:

1. Provide all starters with thermal overload(s); and pilot light(s) and handle lock-out provisions. Gang starter with selector switch for multispeed applications. Provide single or 2-pole as required:

a. 120 volt, single-pole, surface mounted: Square-D FG-5P and handle guard.

b. 120 volt, single-pole, flush mounted: Square-D FS-1P and handle guard.

c. 240 volt, two-pole, surface mounted: Square-D FG-6P and handle guard.

d. 240 volt, two-pole, flush mounted: Square-D FS-2P and handle guard.

e. 120 volt, single-pole, two speed, surface mounted: Square-D FG-11P and handle guards.

f. 120 volt, single-pole, two speed, flush mounted: Square-D FF-11P and handle guards.

g. 240 volt, two-pole, two-speed, surface mounted: Square-D FG-22P and handle guards.

h. 240 volt, two-pole, two-speed, flush mounted: Square-D FF-22P and handle guards.

i. 120 volt, single-pole, H-O-A selector, surface mounted: Square-D FG-71P and handle guard.

j. 120 volt, single-pole, H-O-A selector, flush mounted: Square-D FS-71P and handle guard.

k. 240 volt, two-pole, H-O-A selector, surface mounted: Square-D FG-72P and handle guard.

l. 240 volt, two-pole, H-O-A selector, flush mounted: Square-D FS-72P and handle guard.

m. 120 volt, single-pole, surface mounted, explosion proof: Square-D FR-1.

n. 240 volt, two-pole, surface mounted, explosion proof: Square-D FR-2.

F. Manual Motor Starter - Speed Controller: Shall be similar to "Manual Motor Starter," above, except two-gang with motor speed control sized to handle motor indicated, with positive full on and full off bypass of speed control unit.

G. Manual Starter with Relay: Shall be similar to "Manual Motor Starter," above, except to include a two-gang box with relay sized for load indicated, and hand-off-automatic switch. Connect relay for 120V operation on load side of starter in "automatic" mode. Coordinate connection of Form C maintained contact for control with Mechanical Contractor.

H. Magnetic Starter: Shall be single-speed, across-the-line type rated in accordance with NEMA standards, sizes and horsepower ratings. Starters shall be mounted in NEMA 1 enclosures unless otherwise indicated. Magnetic starters shall be equipped with fused control power transformer for 120V control power and double break silver alloy contacts; all contacts shall be replaceable without removing starter or disconnecting power wiring. Starter shall have straight-through wiring. Coils shall be of molded construction and shall be replaceable from the front without removing starter. Overload relays shall be solid state type with replaceable control circuit module. Thermal units shall be of one-piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed. Provide hand-off-auto selector switch and start-up pushbuttons and "run" pilot light in cover. Wire for maintained contact unless otherwise noted.

I. Combination Magnetic Starter: Shall be similar to "Magnetic Starter," above, except shall include fusible disconnect switch connected ahead of starter. The disconnect handle shall be in control of the disconnect device with the door open or closed. Disconnect handle shall be clearly marked as to whether the disconnect device is "on" or "off".

J. Combination Two-Speed Magnetic Starter: Shall be similar to "Combination Magnetic Starter", above, except with two starters, and six thermal overload units coordinated to match torque and horsepower characteristics of the motor. Starter shall be designed for variable torque operation, and shall be provided with high-low-off-auto selector switch and high and low pilot lights mounted in the cover. Wire for maintained contact unless otherwise noted.

K. Combination Reduced Voltage Magnetic Starter: Shall be similar to "Combination Magnetic Starter," above, except autotransformer closed transition reduced voltage type with autotransformer protection by winding over-temperature device.

L. Packaged Control Unit: Shall be furnished and mounted by others, and installed and connected by Electrical Contractor. This can consist of one or more starters, overloads and additional control devices prewired.

M. Contactor: Shall be similar to "Magnetic Starter", above, except without thermal overload units.

2.4 ENCLOSURES

A. Enclosures: NEMA 250, to comply with environmental conditions at installed location. Provide Type 1 for dry and clean indoor locations, Type 3R for outdoor locations, Type 4X stainless steel for kitchen and wash-down areas, and Type 12 for areas subject to dust, falling dirt, and dripping non corrosive liquids.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive motor controllers, with installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine motor controllers before installation. Reject motor controllers that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor controller installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted ASDs: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks.

B. Wall-Mounted Manual and Magnetic Controllers: Install on walls with tops at uniform height, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks.

C. Floor-Mounting Controllers: Install ASDs on 4-inch nominal thickness concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Roof-Mounting Controllers: Install ASD on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses, heaters in thermal-overload relays (based on actual nameplate full-load amperes) after motors are installed, and install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

I. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between ASDs and remote devices and facility's central-control system.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.

D. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.

E. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify motor controllers, components, and control wiring. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs. Label each ASD with engraved nameplate. Label each enclosure-mounted control and pilot device. Identify all items as described in Section 260501.

3.5 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections for ASDs:

1. Inspect ASDs, wiring, components, connections, and equipment installation.

2. Test insulation resistance for each ASD element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at ASD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager & Owner's Representative before starting the motor(s).

5. Test each motor for proper phase rotation.

6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Tests and Inspections for Manual and Magnetic Motor Controllers:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.

2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition, anchorage, alignment, and grounding, and that the controller is clean.

c. Inspect contactors: Verify mechanical operation and contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

d. Motor-Running Protection: Verify overload element rating is correct for its application and if protection is provided by fuses, verify correct fuse rating.

e. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data.

In the absence of manufacturer's published data, use NETA ATS Table 100.12.

f. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

D. Motor controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the ASD and describes results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust carrier frequency for optimal operation with load and conditions.

D. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager & Owner's Representative before increasing settings.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain motor controllers.

END OF SECTION

LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

A. Provide interior and exterior lighting systems, including luminaires, hangers, supports, fittings, wiring, connections and controls, as indicated in the Contract Documents for complete and operational systems. The lighting layouts on the drawings are diagrammatic only. Refer to architectural "Reflected Ceiling Plans" for exact location of interior luminaires. Luminaires, in general, have been specified for the particular type of ceiling in which they are to be installed. Verify the ceiling construction details and provide luminaires suitable for the respective ceiling types and room finish schedule.

1.3 REFERENCES

A. The following standards, criteria, codes, etc. shall be followed in the manufacture and installation of the lighting systems.

1. NFPA
2. NEC
3. IESNA
4. NEMA
5. ANSI
6. UL

1.4 ENERGY CONSERVATION WORK

A. Work installed as part of this Contract will be eligible for energy rebates/incentives available. The energy rebate shall be paid directly to the Owner. The Division 26 contractor shall cooperate with the Owner and the funding source to provide proof of purchase information, quantities involved, fill out forms, etc., to accommodate all required paperwork. Include all costs associated with this requirement.

1.5 QUALITY ASSURANCE

A. Luminaires shall be as specified in the "Luminaire Schedule". Luminaire types, appearance, characteristics, photometrics, finishes, etc., correspond to the specified manufacturer and associated series or catalog number listed in the "Luminaire Schedule". Products of other listed acceptable manufacturers shall be equivalent in every way to that of the luminaire specified. The Engineer reserves the right to disapprove any luminaire type submitted which they feel is not equal in quality, appearance or performance to the luminaire specified.

B. Manufacturer's luminaire series or catalog numbers listed in the "Luminaire Schedule" indicate quality, type, and style, but may not cover required special design details. Provide luminaires having such special details as noted in the "Luminaire Schedule", as indicated by the specified luminaire model number and as required for proper installation.

C. All luminaires shall be new and bear a Nationally Recognized Testing Laboratories (NRTL) label for the service intended.

D. Luminaires shall be products of manufacturers regularly engaged in the manufacture of the type of luminaires specified and shall be the manufacturer's latest standard design that complies with specification requirements.

E. Verify the availability of all luminaires proposed to be used in the execution of the work prior to submitting same for approval. The discontinuance of production of any luminaire after such approval has been granted shall not relieve the Contractor from furnishing an approved luminaire of comparable quality and design at no additional cost.

F. Photometric and operational data shall be provided only by qualified and certified organizations. Certification documentation shall be submitted with the luminaire information.

G. Should there be any difference between drawings and schedules, secure from Architect/Engineer such information as necessary prior to providing proposal. When finishes are not definitely specified, they shall be as selected by the Architect and not be limited to standard finishes.

H. Locations indicated for luminaires are approximate. Field coordinate exact locations as near as possible to the location indicated. Coordinate with the Engineer for any major location changes.

1.6 SUBMITTALS

A. Product Data: For each luminaire type, include in a single submittal, in order of luminaire designation, the catalog "cut" sheet with complete manufacturer and model number. Product data should include the following:

1. Manufacturer and Catalog Number.

2. Features, accessories, materials and finishes.

3. Physical description and dimensions of luminaires.

4. Life, power input, output (lumens, distribution, CCT, and CRI) and energy-efficiency data.

5. Photometric data and adjustment factors based on laboratory tests (space to mounting height ratio, coefficient of utilization complete values, IES distribution, candlepower distribution by angle and luminaire efficiency). Format shall be in accordance with IES TM-27.

6. Power, signal, and control wiring diagrams between luminaires and controllers.

7. Lens/Louver Type.

8. Driver with each type luminaire as applicable (type, sound rating, overload protection, voltage, input/fixture wattage, ballast factor, power factor, etc.).

9. Certification of IES LM-79, IES LM-80 and TM-21 testing for LED luminaires. Luminaires shall be tested in accordance with IES LM and TM standards.

10. Proof of Energy Star listing.

11. Warranty.

B. Coordination Drawings: Provide coordination drawings in accordance with Section 260500. Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.

2. Suspended ceiling components.

3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.

4. Structure members to which equipment and or luminaires will be attached.

5. Initial access modules for acoustical tile, including size and locations.

6. Items penetrating finished ceiling, including other luminaires, air outlets and inlets, speakers, sprinklers, access panels, ceiling mounted projectors, etc.

7. Coordination of ceiling types and ceiling grids/structure to account for luminaire mounting and space requirements and luminaire lengths.

C. Color Chips: Provide color chips of available finishes for luminaires upon request of Architect/Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Luminaires and equipment shall be delivered with NRTL and manufacturer's labels intact and legible. Broken, cracked and damaged materials and equipment shall be removed from the site immediately and be replaced with new materials and equipment. Luminaires and accessories shall be stored in protected dry locations in their original unbroken package or container. Luminaires shall be protected from dust and dampness both before and after installation. Luminaires shall be protected from paint and cleaning solvents during all phases of construction.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division hazard by a NRTL.

C. UL Compliance: Comply with UL 1598 and UL 8750.

D. Recessed Luminaires: Comply with NEMA LE 4.

2.2 LIGHT-EMITTING DIODE (LED) LUMINAIRES

A. Luminaires shall be identical in construction features, options and appearance to the luminaries specified in the Luminaire Schedule. LED luminaires include white and RGBW systems as indicated on the luminaire schedule.

B. Luminaires shall be provided with all cables, controllers, power supplies, drivers, connectors, terminators and accessories required for a complete installation. LED system shall utilize pulse width modulation, non-linear scaling techniques and reverse polarity protection.

C. Provide dimming down to 10% as a minimum, or to percentage indicated or called for on the drawings. Unless otherwise indicated, the dimming control shall be a 0-10VDC signal

D. RGBW LED systems where indicated shall be capable of at least 8-bit control of red, green, blue and white module. RGBW LED system shall be capable of setting each module with a unique and individual address. Each address shall be controlled independently by DMX or alternate method protocol. All RGB LED fixtures shall undergo a minimum of eight-hour burn-in testing during manufacturing.

E. LED luminaires shall be high brightness and binned for forward voltage, luminous flux and wavelength.

F. LED luminaires shall be tested in accordance with IESNA LM-79 (luminous output, power input, luminaire efficacy (lumens/watt), color temperature and color rendering index), IESNA LM-80 (L70, output luminous maintenance, 10,000 hour minimum test, calculation method is not acceptable) and IESNA TM-21/28. Luminaire output shall be a minimum of 100 lumens/watt. Rated life shall be a minimum of 50,000 hours at 70% output. Testing shall be performed by a US Department of Energy (DOE) accredited laboratory.

G. Drivers shall be solid state Class 1 power supply/driver with universal input (120-277V). The system shall have a minimum 90% power factor, 3.5 maximum crest factor, minimum efficiency of 90%, a maximum of 20% THD and overload protection. Adequate heat sink capability shall be provided to ensure the rated life. Unit shall meet FCC rules and regulations.

H. Where indicated luminaires shall have color tuning capability and control. System to have separate dimming (5-100%) and color (3000K to 5000K, or as indicated on drawings) adjustability. Control shall be Dali or DMX512 for controllability as indicated. The system shall utilize the most recent settings when energized.

I. The luminaire (to include LED sources and drivers) shall have a full five (5) year minimum warranty for replacement and labor.

1. Acceptable LED Manufacturers:

a. Philips
b. Osram
c. Cree
d. Nichea
e. Lumiled

J. LED Emergency Drivers:

1. LED emergency drivers shall have the following minimum requirements:

a. Operate indicated fixtures at full illumination for 90 minutes minimum.

b. Universal voltage input (120 to 277V).

c. Upon loss of normal power, fixtures shall automatically switch to battery power.

d. Upon restoration of normal power, fixture shall return to normal mode and charge battery.

e. Battery shall be maintenance free, nickel cadmium type with a minimum life expectancy of seven (7) years.

f. Driver shall be suitable for the environment installed.

g. Driver shall be Class 2 and enclosed entirely in the fixture (except for down lights and exterior locations).

h. Units shall be listed for UL924 -Emergency Lighting and Power Equipment.

i. Minimum five (5) year non-prorated full warranty.

j. Factory installed.

k. Shall include an emergency system test switch above ceiling adjacent to fixture.

l. Unit shall be self-testing and provide indication of unit failure.

m. Design Make: Iota, ILB-CP series or approved equal.

2.3 EXIT LUMINAIRES:

A. Electrical Characteristics:

1. LED type for 120/277 volt supply.

2. Meet or exceed illumination requirements of NFPA 101 and all of the requirements of UL924.

3. Maximum input power of 5 watts per illuminated face.

4. Provide Universal mount unit.

5. Provide single or double face and arrows as indicated on Contract Documents.

6. Acceptable Manufacturers:

a. Per Contract Documents luminaire schedule

2.4 EMERGENCY LIGHTING UNIT WITH BATTERY BACK-UP:

A. Completely self-contained in compact, low profile injection molded UL 94V-0 flame rated thermoplastic housing, damp location rated with universal mounting plate.

B. Premium grade, pure lead maintenance free battery with sufficient capacity to operate the light sources for 90 minute to an end voltage of 87-1/2% of nominal battery voltage. Three stage charger (constant current, equalize and float charge), relay, low voltage battery disconnect and brownout protection circuits.

C. Glare-free LED type lighting source. Test switch and charge rate indicator.

D. Universal 120/277 volt supply.

E. Photometric output: for a location with 8' unit mounting height, 9' ceiling, 8' wide corridor and 80/50/20% reflectance, multiple unit spacing shall be:

1. Standard unit - 30' on center.

2. High output (HO) unit - 60' on center.

F. Acceptable Manufacturers:

1. Standard unit: Dual-Lite EV Series (Design make)

2. High output unit: Dual-Lite EVHC Series (Design make).

3. Approved equal.

2.5 LUMINAIRE CONSTRUCTION

A. Metal Parts:

1. Free of burrs and sharp corners and edges.

2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.

C. Lenses:

1. Shall be listed materials tested in accordance with ASTM D-635, "Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position" and burns less than 2/5 inches per minute.

2. The products shall have a smoke density of less than 75 when tested in accordance with ASTM D-2843, standard test method for "Density of Smoke from the Burning or Decomposition of Plastics".

3. The flame spread rating shall not exceed 0-25 and smoke developed rating shall not exceed 450 in accordance with ASTM E-84, standard test method for "Surface Burning Characteristics of Building Materials".

4. Self-ignition shall not occur below 600°F, in accordance with ASTM D-1929, standard test method for "Ignition Properties of Plastics".

5. Materials shall remain in place 15 minutes at 175°F and fall from frame at 200° below ignition temperature in accordance with ASTM D-648, "Deflection Temperature of Plastics Under Flexural Load".

2.6 LUMINAIRE SCHEDULE

A. Luminaire schedule is found on the contract drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

A. Comply with NECA NEIS (National Electrical Installation Standard) latest edition.

B. All luminaires shall be installed as per manufacturer furnished installation instructions.

C. Provide for every luminaire as shown on the plans, or as scheduled on the drawings.

D. Location of all ceiling and wall mounted luminaires shall be as indicated on the Architectural and Electrical drawings. The contractor shall verify ceiling type, construction, and material prior to ordering.

E. Provide luminaires with an IC rating for luminaires installed in direct contact with insulation.

F. Provide plaster frames for plaster ceilings and flanged frames for drywall ceilings.

G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

H. Luminaires shall be suitable and as recommended by the manufacturer for the actual intended mounting method and materials.

I. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and maintenance.

3. Provide support for luminaire without causing deflection of ceiling or wall.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

J. Flush-Mounted Luminaires:

1. Secured to outlet box.

2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.

3. Trim ring flush with finished surface.

K. Wall-Mounted Luminaires:

1. Attached to structural members in walls, to a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.

2. Do not attach luminaires directly to gypsum board.

L. Suspended Luminaires:

1. Pendant and Rods:

a. Pendant mount luminaires from 1/4 in. threaded rods of required length.

b. Sleeve threaded rods with 1/2 in. EMT painted with color as directed by Architect/Engineer.

c. Brace pendants and rods longer than 48 inches to limit swinging.

2. Aircraft Cable:

a. Cables shall be 1/16 in. aircraft cable with end safety fittings.

Cable shall be provided with 2 in. diameter mini-canopy and threaded coupler for attachment to a 1/4 in.-20 threaded stud extending 3/4 in. below ceiling.

b. Cable assembly shall include a spring-loaded adjustment device mounted in the fixture.

c. The Contractor shall be responsible for providing required supports for cable attachment.

d. For cord feed to the luminaire provide continuous cord clip of matching color to attach the cord to the cable.

e. Support per manufacturer's recommendations.

3. Support stem mounted, single unit luminaires with approved outlet box and accessories that hold them and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

4. Use tubing or stem for wiring at one point of continuous rows of luminaires and tubing, rod, or wire support for suspension for each unit of length of luminaire chassis, including one at each end.

M. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.

2. Use approved devices and support components to connect luminaire to building structure in a minimum of four locations, spaced near corners of luminaire. Utilize #10 steel wire; similar to that used to support the ceiling grid.

3. Provide UL listed seismic hold-down clips and fasten to luminaires and to ceiling grid members at or near each luminaire corner.

4. Install luminaires of sizes less than ceiling grid as indicated on reflected ceiling plans or center in acoustical panel and support luminaire independently with at least two metal channels spanning and secured to ceiling tees.

5. Contractor to verify luminaire mounting and supports are compatible with the ceiling grid type and mounting/support requirements.

6. Contractor to coordinate recessed linear luminaire run lengths with the ceiling grid layout and required mains supports. All continuous run lengths to be verified and coordinated prior to determining the final housing lengths.

N. Cove Lighting:

1. Installed so as to produce a continuous and unbroken band of light with no shadows or light gaps.

O. Provide all necessary accessories for "end-to-end" mounting where continuous rows of luminaires are indicated. All luminaire assemblies shall be grounded.

P. Luminaires installed in continuous rows may be fed by a single outlet if luminaires are UL approved and suitable for through wiring in luminaire raceway.

Q. New luminaires may be provided to replace existing luminaires indicated to remain or be reused, subject to shop drawing approval.

3.3 REMOTE DRIVERS

A. Remote drivers shall be mounted in an approved NEMA 1 enclosure and shall be located in areas easily accessible to maintenance personnel.

B. Wiring from luminaire to remote driver shall not exceed the driver manufacturer's recommendations for distance.

C. Remote driver shall be clearly labeled indicating fixture served, voltage, panelboard and circuit number served from.

3.4 GROUNDING

A. Ground all non-current carrying parts of all lighting luminaires.

B. All grounding shall be accomplished with NRTL tested grounding connectors suitable for this purpose.

3.5 LABELING

A. Attach a self-adhesive red dot label, 1/2 in. in diameter, to all luminaires with an integral battery backup and/or those tied into an emergency generator. Labels shall be attached to these fixtures or to adjacent ceiling tiles so that they are readily discernible for testing and maintenance purposes.

3.6 FINAL CLEANING

A. Immediately prior to acceptance, damp clean diffusers, luminaire trim, reflectors, louvers, lens, and similar objects of all luminaires. Remove all dirt, corrosion, foreign material, finger marks, and blemishes. Replace all burned out LEDs and failed components.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test of Emergency Lighting: Under supervision of Engineer, interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

D. Replace luminaires damaged during shipment, construction, or installation.

3.8 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260936 "Lighting Controls."

3.9 ADJUSTING

A. Provide adjusting the direction of aim of luminaires to suit occupied conditions. Adjustment may be required during hours of darkness.

B. Final distribution shall be acceptable to the Owner and may take several attempts.

3.10 REMOVAL OF BALLASTS IN EXISTING LUMINAIRES

A. Assume ballasts contain PCB material unless labeled otherwise or test samples show materials are not PCB; submit a test report. Remove all ballasts from existing luminaires indicated on contract documents. Dispose of all ballasts which do not have non PCB labels in PCB containers and pay all costs to have containers taken to EPA approved incinerators and disposed of all EPA regulations. Follow all EPA regulations for transporting material. If ballast has leaked in existing luminaires, remove material deposited in luminaire and dispose of those materials as indicated above. Provide documentation verifying disposal of PCB contaminated ballasts.

3.11 REMOVAL OF LAMPS IN EXISTING LUMINAIRES

A. The Contractor shall employ the service of a certified disposal/recycling service company to dispose of all removed fluorescent and/or HID lamps. All disposal procedures shall be performed in accordance with EPA Requirements and Subtitle C for the disposal of mercury contaminated lamps.

END OF SECTION

LIGHTING CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a complete lighting control system as indicated on the Contract Documents and as specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 QUALITY ASSURANCE

A. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers.

B. Installation shall be accordance with NFPA 70 (National Electrical Code), energy conservation codes, state codes, local codes, and requirements of authority having jurisdiction.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA and IEEE Standards.

D. All equipment shall NRTL tested.

E. All components and assemblies are to be factory pretested.

F. The controls provider must:

1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed similar systems, utilizing their standard products, for a minimum period of five (5) years.

3. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

4. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system.

If requested, must provide a listing of tools and/or equipment and where

appropriate, certifications in the proper training and use of the tools and/or equipment.

1.4 SUBMITTALS

A. Submit the following equipment, materials, and products including all components and accessories:

1. General Equipment

2. Vacancy/occupancy Sensors

3. Digital Lighting Control System

4. Lighting Control Panels

5. Emergency Lighting Control Devices

6. Wiring diagrams

7. Commissioning Plan

B. Submit the shop drawings and the product data specified below at the same time as a single submittal package.

C. Product Data: Provide equipment data sheets, specifications, wiring diagrams and installation instructions for all required system components.

D. Shop drawings shall include the following at a minimum:

1. Composite custom wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted). Wiring diagrams shall include all system components, including but not limited to: room controllers, digital switches, vacancy/occupancy sensors, photocells, isolated relays, digital I/O interfaces to conference room A/V systems, network interfaces, lighting control panels and associated components.

2. Scaled drawing for each area showing exact location of each room controller(s), digital switch(es), vacancy/occupancy sensor, daylight sensor, lighting control panel and other associated system components.

3. All system devices shall be located per the system manufacturers recommendations. All devices shall be suitable for the building configuration and intended operation.

1.5 SYSTEM DESCRIPTION

A. The lighting control system and/or components, as specified and indicated on the drawings to provide the intended and required control of the lighting systems.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT

A. Switches

1. Toggle/Snap

a. Unit shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, 90° rear plug in termination with pig tail, with nylon/polycarbonate toggle, self grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20.

b. Acceptable Manufacturers (for single pole units, provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model).

1) Hubbell HBL1221

2) P&S 20AC1

3) Leviton 1221-2

2. Low Voltage

a. Unit shall be button type switch that is configurable from one button to eight buttons using point-to-point low voltage wiring for control of single or multiple loads. Each button shall provide a momentary contact and all share a common return. The switch shall be totally passive and contain no active electronics or power supply. Operation is dependent upon a Class 2 connection to a compatible relay panel or other device that can react to a momentary contact signal.

b. Each button shall have an LED indicator light that can serve as a status indicator or as a locator light. The LED indicators shall be powered by a 24VDC source originating from the lighting control panel or other device. The button quantities shall be as indicated on the plan views.

c. Acceptable Manufacturer

1) Wattstopper LVSW series (Design Make)

2) Acuity Brands

3) Hubbell

4) Approved Equal per Cornell Standards.

3. All device colors shall match the surrounding devices and shall be selected by the Architect.

B. Lighting Dimmers

1. Provide lighting dimmer where indicated suitable for the type of luminaire for even continuous control. Unit shall be rated for the indicated connected load plus 25% minimum (even when ganged). Review luminaire schedule and plans for type and loading. Provide for three-way control as indicated.

2. Low voltage dimming shall be as recommended by the luminaire manufacturer for magnetic or solid state.

3. LED dimmers shall be as recommended by the luminaire manufacturer and be listed for use with the associated driver.

4. Device color shall match the other project devices.

5. Acceptable Manufacturers:

a. Lutron (Design Make)

b. Crestron

c. Acuity Brands

d. Leviton

e. Approved equal per Cornell Standards

C. Time Switches:

1. Digital Lighting Controller:

a. Photosensor and manual inputs, battery back-up.

b. Astronomic control with holiday, 7 day and 56 point scheduling.

c. 120/277V input/control, SPDT 20A output.

d. NEMA 3R corrosion resistant enclosure with clear cover.

e. Design Make: NSI-Tork DGLC200A.

2. Electromechanical Controllers:

a. DPST, 40A per pole: NSI-Tork 120V - 7002Z, 277V - 7202Z

b. 3PST, 40A per pole at 277 volt: NSI-Tork 7302Z.

c. Two-circuit lighting control center: NSI-Tork T-920L.

d. Three-circuit lighting control center: NSI-Tork T-903-L.

3. Digital Time Switch (for use with Lighting Contactor):

a. SPDT, 7-day with 14 set points.

b. Digital, AM/PM Clock with LCD display.

c. Battery backup to keep program in memory for approximately seven (7) days.

d. 120V Make: NSI-Tork EW120 or equal.

e. 277 Make: NSI-Tork EW120-3 or equal.

4. Time switches shall be provided with NEMA 1 general purpose, surface mount enclosures unless otherwise noted.

D. Elapsed Time Switches:

1. Mechanical spring wound timer, which requires no electricity to operate the timing mechanism. Device shall fit a standard 2-1/2 in. deep wall box. Switch contacts shall break current carrying contacts at the end of the timed cycle.

a. 0-30 Minutes: NSI-Tork A530M or equal.

b. 0-4 Hours: NSI-Tork A504HH or equal.

c. 0-12 Hours: NSI-Tork A512 or equal.

E. Digital Programmable Time Switch:

1. Programmable countdown time switch to automatically turn lighting or other loads off when the programmed on-time expires. 120VAC, 60Hz, neutral required with a 0-600W load rating suitable for incandescent, LED, fluorescent, magnetic low voltage, electronic low voltage and 1/6HP motor. Adjustable on-time from 5-55 minutes (5 minute increments) to 1-12 hours (15 minutes).

a. Wattstopper RT-100 (Design Make)

b. Acuity Brands

c. Hubbell

F. Photoelectric Controls:

1. Heavy Duty, 1/2 in. Conduit Mounting:

a. 120 volt, SPST, 2000 watt: Tork Model 2101.

b. 277 volt, SPST, 2000 watt: Tork Model 2104.

2. Combination Photoelectric Control and Contactor:

a. 120 volt, DPST, 3000 watt per pole: Tork Model 5403.

b. 277 volt, DPST, 3000 watt per pole: Tork Model 5404-3.

c. 208 volt, DPST, 3000 watt per pole: Tork Model 5404.

G. Lighting Contactors

1. Similar to magnetic motor starters without overloads. Refer to specification 262000.

2. Mechanically held, electrically operated with control as indicated.

3. NEMA 12 enclosure.

4. Supply with appropriate accessories to interface with 2-wire and 3-wire control devices as required by the Construction Documents.

5. 22,000 ampere withstand at 250V.

6. 30 ampere continuous current rating per pole at 600VAC.

7. Number of poles as indicated.

8. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:

a. ASCO 918 Series.

b. Square D Class 8902

c. Eaton

d. GE

2.2 VACANCY/OCCUPANCY SENSORS

A. Vacancy/occupancy Sensors:

1. Vacancy/occupancy sensors shall comply with the following as a minimum:

a. Zero crossing switching operation (switch on/off only where sine wave is at zero volts) suitable for linear, non-linear and electronic/magnetic fluorescent ballasts for the loads indicated. Where the load to be controlled exceeds the sensor load rating provide a separate relay of adequate rating.

b. Failure of the unit shall be to the on/closed position or manual operation.

c. Motion sensitivity adjustment (dip switch or dial) and time delay adjustment (5 to 30 minutes minimum, dip switch or dial).

d. Line voltage input and switching. Field selectable for 120 or 277 VAC, 60 Hz.

e. UL listed and have a five (5) year manufacturer full replacement warranty.

f. Test mode feature to override the set time delay to allow adjusting of the sensitivity.

g. Sensor locations shall be adjusted during construction and at occupancy as recommended by the manufacturer for optimal sensing and operation.

h. Operation shall be field selectable with vacancy sensor being manual "on" with close switch/contact upon motion sensing and open after the set amount of time delay without motion or occupancy sensor being automatic on upon motion sensing.

i. Adjustable controls/settings shall only be accessible when the front cover is removed or from the back of the unit.

j. Unit color shall match the project devices except for the ceiling-mounted units which shall match the ceiling color. All color selections shall be by the Architect.

k. Ultrasonic sensing shall not be affected by air movement and shall operate at 32 kHz minimum (shall not interfere with hearing aids or other equipment).

l. Provide components as needed for the indicated control.

m. A factory-authorized representative shall coordinate and instruct the startup services of the sensors providing placement recommendations, connection guidance and startup supervision and adjustment.

2. Ceiling Mounted - Ultrasonic (Subscript "U"):

a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize ultrasonic sensing.

b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.

c. Sensing shall be 360 degrees with a minimum operating area of:

1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.

d. Corridor (Major Motion): 50 ft. x 16 ft.

e. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.

f. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.

g. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

h. The maximum depth shall be 1.5 in. below the ceiling/box.

i. Acceptable Manufacturers:

1) Wattstopper WT Series (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

3. Ceiling Mounted - PIR Technology (No Subscript):

a. Unit shall mount to standard octagonal box, have auxiliary contact (Form C, 0.5A at 24 VDC), and utilize PIR technology motion sensing.

b. Shall have self-contained rated contacts or control a separate switch pack. If a self-contained unit, then the ratings and function shall meet or exceed the switch pack specifications.

c. Sensing shall be 360 degrees with a minimum operating area of:

1) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.

2) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.

d. Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.

e. Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.

f. Ambient light level sensing (adjustable 20-300 fc) to prevent "On" operation when the ambient light level is greater than the setpoint level.

g. The maximum depth shall be 1.5 in. below the ceiling/box.

h. Acceptable Manufacturers:

1) Wattstopper CI-24 (Design Make)

2) Hubbell

3) Eaton

4) Acuity Brands

B. Switch Pack:

1. Provide a minimum of one (1) switch pack for each ceiling-mounted vacancy/occupancy sensor. Provide additional units for multiple circuits (quantity to match the quantity of circuits).

2. Unit shall be plenum rated with line voltage side into a metallic box.

3. Low voltage power shall be suitable for a minimum of three (3) sensors. Multiple sensors shall be able to control a single switch pack.

4. Minimum switching capacity shall be 20A (all types of loads) at 120/277 VAC.

5. Shall have enough spare contacts provided at each sensor for HVAC system connection

2.3 DIGITAL LIGHTING CONTROL SYSTEM

A. General:

1. All associated system components shall be supplied from a single manufacturer and shall be compatible for communication as part of a digital lighting control network. All digital lighting controls shall be implemented without a broad digital lighting control network and without external communication. Separate rooms shall not be interconnected unless necessary to achieve the control outlined in the documents. Combining multiple manufactures system components to achieve the required system operation is not acceptable.

B. Vacancy/Occupancy Sensors:

1. Wall or ceiling mounted (to suit installation) passive infrared occupancy sensor. Provide unit to accommodate the square-foot coverage requirements for each area controlled.

2. Sensors shall have adjustable settings and features as noted below. Sensor shall be adjusted through one of the following: graphic LCD display, push button or via software from handheld device.

a. Sensitivity: 0-100% in 10% increments.

b. Time Delay: 1-30 minutes in 1 minute increment. Time delay shall be set 30 minutes.

c. Detection Technology: Dual technology activation and or re-activation. The sensor shall be capable of being set to either PIR & Ultrasonic, PIR Only or Ultrasonic Only as required by the space being controlled as recommended by the manufacturer.

d. Test mode – Five second time delay

e. Walk-through mode

f. Selectable operating parameters shall include as a minimum Auto (Occupancy) / Manual (Vacancy) - ON, blink warning, and daylight enable/disable when photosensors/day-light sensors are included in the digital network.

3. Sensing shall be 360 degrees with a minimum operating area of:

1) Ultrasonic: 25 ft. x 25 ft.

2) Passive Infrared: 32 ft radial.

4. RJ-45 port(s) for connection to digital lighting control network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration device and control by remote personal controls.

6. Assignment of occupancy/vacancy sensor to a specific load within the room without wiring or special tools.

7. Manual override of controlled loads.

8. Multiple occupancy sensors shall be installed in a room if required by the size/configuration by connecting them to the open topology digital lighting control network. No additional configuration shall be required.

9. Provide wall or ceiling mounted sensors as indicated on the drawings. Final locations of all sensors shall be in accordance with the manufacturer's recommendations.

C. Digital Daylight Sensor:

1. Digital daylighting sensor shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.

a. Closed loop sensors measure the ambient light in the space and shall control a single lighting zone.

2. Digital daylighting sensors shall include the following features:

   a. Sensor's internal photodiode shall only measure light waves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.

   b. Sensor light level range shall be from 1-6500 foot-candles (fc).

   c. Capability of ON/OFF, bi-level, tri-level switching or dimming, for each controlled zone, depending on the selection of load controller(s) and loads assigned to controller(s).

   d. For switching daylight harvesting, the daylight sensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.

   e. For dimming daylight harvesting, the daylight sensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.

   f. Daylight sensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

   g. Daylight sensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.

   h. Integral infrared (IR) transceiver/sensor for configuration and adjustment using a handheld configuration device.

      1) Configuration LED status light on device that blinks to indicate data transmission.

      2) Status LED indicates test mode, override mode and load assigning.

   i. Recessed switch on device to manually turn controlled load(s) ON and OFF.

   j. RJ-45 port(s) for connection to digital lighting control network.

   k. A choice of accessories to accommodate multiple mounting methods and building materials. Daylight sensors shall be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Unit mounting shall be suitable for the intended location.

l. Any load or group of loads in a room shall be assignable to a daylighting zone.

m. Each load within a daylighting zone shall be individually enabled or disabled for discrete control (load independence).

n. All digital parameter data programmed into a daylight sensors shall be retained in non-volatile memory within the daylight sensors itself. Memory shall have an expected life of no less than 10 years.

D. Digital Wall Controller

1. General - Digital controllers may consist of multiple configurations and devices including but not limited to digital switches, dimmers and scene controllers. The digital controllers shall provide the control intent indicated on the drawings and connected to the digital lighting control network. Individual device operation shall meet the features indicated below.

2. Digital Switch - low voltage momentary pushbutton switches to have 1, 2, 3, 4, 5 and 8 button configurations; colors to be white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. The color shall match the other devices and be coordinated with the Architect. Wall switches shall include the following features at a minimum:

a. Fully configurable and adjustable using a handheld configuration device.

b. Label each button and/or controller with custom silk screen labeling. Labeling identification shall be coordinated with the Owner for identification once the system has been configured.

c. Button covers shall be field replaceable. Button replacement may be completed without removing the switch from the wall.

d. Indicating LED on each switch that blinks to indicate data transmission.

e. Scene Status LED on each switch button with the following characteristics:

1) Bi-level LED that is field configurable.

2) LED status indicates power to switch

3) Bright status level indicates that load or scene is active

f. RJ-45 port(s) for connection to digital lighting control network.

g. Multiple digital wall switches shall be installed in a room by connecting them to the open lighting control network. No additional configuration shall be required to achieve multi-way switching.

h. The following switch attributes shall be changed or selected using a handheld configuration device:

1) Load and Scene button function reconfigured for individual buttons (from Load to Scene, and vice versa).

2) Individual button function may be configured to Toggle, On only or Off only.

3) Individual scenes may be locked to prevent unauthorized change.

4) Switch buttons may be assigned to any load on any room controller and are not load type dependent; each button may be assigned to multiple loads.

3. Digital Dimming Switch - shall have the same features as the digital switches. Dimming switches shall have a raise/lower buttons that include LEDs to indicate the load dimming level. Buttons shall be labeled "UP" and "DOWN". The dimmer shall provide full function dimming control in multi-way applications, such as 3-way, 4-way and beyond.

a. The following dimmer switch attributes shall be changed or selected using a handheld configuration device:

1) Fade Up and Fade Down times for individual scenes and loads adjustable from 0 seconds to 18 hours.

2) Ramp rate adjustable for each dimmer switch from 0 to 10 minutes.

4. Digital Scene Selector - shall have the same features as the digital switches. Scene selector switches shall have four programmable preset scene buttons and a separate master button to allow dimming raise/lower and all-on/all-off control of the individual scenes. The buttons shall have suitable labels.

E. Room Controllers

1. Room Controllers automatically assign the room loads to the connected devices in the space without the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall not have, dip switches, potentiometers or require special configuration. The Room Controllers shall provide on/off/dimming control and shall include the following features as a minimum:

a. Replacement: Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

b. Device status LEDs to indicate:

1) Data transmission

2) Device has power

3) Status for each load

c. Installation features:

1) Standard junction box mounting

2) Low voltage connections using standard RJ-45 patch cable

d. UL 2043 plenum rated system.

e. Manual override and LED indication for each load

f. Dual voltage input (120/277VAC, 60 Hz).

g. Maximum of 20A combined load per Room Controller. Each relay rated for the following at 120/277VAC, 60 Hz:

1) 20A magnetic ballast or incandescent.

2) 16A electronic ballast or LED driver (meet NEMA 410 ratings).

3) 1/2 HP motor load.

h. Zero cross circuitry switching for each load.

i. One, two or three relay configuration. Provide additional room controllers networked together to accommodate the quantity of zones indicated on the drawings and as indicated in the room sequence of operation.

j. Equipment shall be suitable for the operating conditions within the intended locations.

k. RJ-45 digital lighting control network ports with the ability to connect all required room control devices for communication to the digital lighting control network.

l. Class 2 output to digital lighting network room devices suitably sized to power the devices within the room.

m. One (1) 0-10VDC analog class 2 dimming control signal per channel for control of compatible dimming ballasts and LED drivers.

n. The following dimming attributes shall be capable of being changed or selected using a handheld configuration device:

1) Establish preset level for each load from 0-100%

2) Set high and low trim for each load

3) Fade time from 0 seconds to 18 hours.

4) Set controller for switched or dimmed applications

F. Handheld Configuration Tool

1. Provide a configuration tool to facilitate optional customization of digital lighting control system, and used to set up open loop daylighting sensors. The handheld configuration tool shall either be a separate device using wireless infrared communications or be a downloadable application to a user's cell phone using wireless communications.

2. Features and functionality of the handheld wireless configuration tool shall include:

a. Two-way infrared (IR) communication with system devices within a range of approximately 30 feet.

b. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

c. Read, modify and send parameters for occupancy/vacancy sensors, daylighting sensors, room controllers and buttons on digital wall switches and network settings.

d. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

e. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting.

f. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

3. Provide a total of two (2) configuration tools or free access to the downloadable cell phone application. The units shall be turned over to the Owner to allow for future modifications to the digital lighting control system setup and programming.

G. Acceptable Manufacturers:

1. Wattstopper: Digital Lighting Management - DLM, (Design make).

2. Crestron Controls: GLPAC

3. Hubbell NX

2.4 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Relay

1. Emergency Lighting Relay – To be a UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit shall provide normal ON/OFF or dimmed and dimming control of emergency lighting to match the normal lighting.
Upon normal power failure the emergency lighting circuit shall close, forcing the emergency lighting ON until normal power is restored. Features to include:

a. 120/277VAC, 60 Hz, 20A LED driver or electronic ballast rating. The relay voltage ratings shall match the lighting branch circuits.

b. Push to test button. Final button locations shall be coordinated with the Owner.

c. Auxiliary dry contact control for remote test switch or fire alarm system interface operation.

d. Provide separate auxiliary shunt relay when used with dimming driver/ballast to automatically open the 0-10VDC dimming control signal to automatically for the emergency luminaires to 100% output.

2. Acceptable Manufacturer:

a. Wattstopper - ELCU-200 (Design Make)

b. Functional Devices - ESRN

c. Acuity Brands

B. Emergency Lighting Bypass/Shunt Relay

1. Emergency Lighting Bypass/Shunt Relay - To be a UL 924 listed device that is suitable for shunting around wall/dimmer control switches in order to turn on emergency lighting when normal utility power is lost. Upon normal power failure, the relay coil is deactivated and the normally closed contact falls closed bypassing the lighting control switches or dimming controls to automatically turn the emergency lighting ON. Features to include:

a. 120/277VAC, 60 Hz, 20A LED driver or electronic ballast rating. The relay voltage ratings shall match the lighting branch circuits.

b. Provide SPDT or DPDT application based on the specified lighting control system and the relay manufacturer's requirements.

2. Acceptable Manufacturer:

a. Functional Devices - ESR Series (Design Make)

b. Iota

c. Acuity Brands

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all required system components, interconnection wiring and branch circuit power connections as required by the lighting control system manufacturer to meet the intended sequence of operation and system performance requirements. All system wiring shall be in accordance with the system manufacturer's requirements at a minimum.

B. When using wire for connections other than the digital lighting control network (Category 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements. All Category 5e cabling and connectors shall be terminated and tested to meet the system manufacturer’s requirements. Category 5e cabling shall have a green thermoplastic jacket to easily identify from other building network cabling, building management system, or other low voltage systems cabling.

C. All line voltage wiring shall be installed in conduit. Terminations shall be done above accessible ceilings or within utility rooms and within a 4"x4" back box and have a suitable cover provided. Digital network devices (room controllers, isolated relays, plug load controllers, etc.) shall be mounted to a junction box and connected as recommended by the system manufacturer.

D. All low voltage control cabling shall be plenum rated. Cabling shall be installed in minimum 3/4" conduit in vertical runs in walls/partitions and inside mechanical/utility rooms. Provide suitable back box as required by the system manufacturer for the device being installed. Above accessible ceilings all control cabling shall be installed within separate J-hook supports located at 3' on center with the cabling neatly bundled. All cabling inside utility rooms without ceilings shall be installed in conduit.

3.2 SYSTEM PROGRAMMING

A. Upon completion of the installation, the system shall be programmed by the manufacturer's factory authorized representative who shall verify a complete fully functional system.

B. The system manufacturer shall include separate individual site visits scheduled to complete the system programming and perform the following functions:

1. Initial system startup/programming (time shall be suitable to setup all system devices). A minimum of two days shall be accounted for the system initial setup.

2. Coordination with the owner to develop preferred lighting control scenes, scene illumination levels, button operation and coordinate day lighting requirements prior to final system programming. Once verified with the owner all system components shall be fully programmed and setup.

3. Verification of the system operation (time shall be suitable to test and verify day lighting functions are operating properly). The manufacturer shall provide light meters for verification; time shall be as required for proper testing of the system.

4. The lighting control system manufacturer shall coordinate all room names and scheduling with the owner prior to final setup.

5. The presence of the system manufacturer's service technicians to assist the installing electrician in all of the above is a requirement of this project and proof of time expended shall be provided to the Owner's Representative.

3.3 SYSTEM COMMISSIONING

A. The electrical contractor shall provide both the Owner and the electrical engineer with a minimum of ten working days written notice of the system startup and configuration date.

B. Refer to the lighting control details that are part of the Construction Drawings for sequence of operation and commissioning requirements of the project lighting control scenarios.

C. All lighting control systems and components shall be commissioned to verify sensor location, time delay/sensitivity is properly set, auto-on/manual-on, override times, controls, day-lighting control, communications between control panels, and timeclock controls are operating as intended.

D. Calibrate all sensor time delays, sensitivity settings and properly aim to guarantee proper detection of occupants and energy savings.

1. Adjust time delay so that controlled area remains lighted for 15 minutes after occupant leaves area.

E. Exterior photocells shall be aimed per the manufacturer's installation instructions. Locate and aim to be facing to the north and avoid being blocked by the building architectural features.

F. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting set points.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)

G. Re-commissioning – After 60 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Engineer / Owner of re-commissioning activity.

3.4 SYSTEM TRAINING

A. The Contractor shall provide instruction to the Owner's Representative with regard to use and operation of the system. Obtain signed receipt from Owner's Representative that instruction has been given.

B. The lighting control system's manufacturer shall supply at least one (1) service technician after all systems have been tested and in full operation as described above to assist the installing electrician to demonstrate and instruct the Owner's Representative on the operation, programming and any uniqueness of the control system. Minimum time required for Owner instruction of the system is one (1) eight (8) hour session. Provide additional instruction and training to the owner to as required to verify the owner is comfortable with the system operation. Time of demonstration and instruction to be at Owner's convenience during normal working hours and shall be scheduled a minimum of ten working days prior.

3.5 WARRANTY

A. Provide a five year complete manufacturer’s warranty on all products to be free of manufacturers’ defects.

3.6 MAINTENANCE

A. Spare Parts:

1. Provide the following spare parts/components to be used for the owner’s maintenance. The spare parts shall be fully tested for proper operation and turned over to the owner in the original boxes:

a. Digital Light Control System

1)	(3)	Ceiling mounted occupancy/vacancy sensors
2)	(1)	Digital daylight sensor
3)	(2)	Isolated relay interfaces
4)	(3)	Room controllers
5)	(2)	Digital switches
6)	(2)	Digital dimmers
7)	(1)	Scene Control Switch
8)		500’ of spare cabling that meets the manufacturers wiring requirements.

END OF SECTION

LOCAL AREA NETWORK SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment, services, etc. for a complete functional Local Area Network (LAN) and related work as required in the Contract Documents.

B. The systems to be provided shall be for a switched LAN environment. The system shall hereafter be referred to as the Data Network System.

C. Basic Intent:

1. Located throughout the building as shown on the drawings, are places where computers and associated equipment are intended to be placed and connected to the network for the purposes of utilizing common resources.

2. The telecommunications rooms for the data network in the building(s) are located as shown on the drawings.

3. Located in various other places are additional Telecommunication Rooms. It is intended that these be connected with the Main Telecommunication Room by a fiber optic cable backbone. From each of these locations, data cable is to be run to the data jacks where computer equipment is connected.

4. Patch panels shall be used as termination points for all fiber optic cabling. Provide backbone cabling between telecommunication rooms as indicated.

5. Patch panels shall be used as termination points for all data cables and the individual fiber cables in telecommunication rooms.

D. Description of System:

1. The system shall include the items listed below, as described herein and as indicated on the Contract Documents:

a. Data network shall be compatible with existing network configuration and characteristics.

b. Campus service to the building(s).

c. Building Main Distribution Frame (MDF) for service entrance and distribution.

d. Intermediate Distribution Frame (IDF) as indicated for cabling distribution.

e. Backbone wiring from entrance facility to the MDF and from MDF to the IDFs.

f. Complete raceway system (cable tray, J hooks, conduit) for cabling distribution as noted on Construction Drawings.

g. Grounding of all racks, raceway and equipment.

h. Power for the telecommunication rooms.

1.2 TELECOMMUNICATION ROOMS

A. Each telecommunication room shall be furnished with 3/4 in. plywood backboard, floor to ceiling on all walls, with the plywood backboard painted with two (2) coats of fire resistant paint (UL/ASTM Class A), all surfaces.

1. ANSI/TIA/EIA Telecommunications Building Wiring Standards.

2. IEEE Telecommunications Standards.

3. BICSI Methods Manuals.

4. NFPA 70: NEC

1.3 QUALITY ASSURANCE

A. Work shall be as specified herein and it shall be neat and orderly installation. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.

B. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

C. Installation shall be accordance with NFPA 70 (National Electrical Code), TIA/EIA, IEEE, IEC, state codes, local codes, and requirements of the Authority Having Jurisdiction.

D. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMAIEC, TIA/EIA and IEEE Standards.

E. Each item shall be NRTL tested and listed.

F. The system provider must:

1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years.

3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day; 365 days per year and staff must be adequate to respond within two (2) hours of an emergency call.

4. Maintain adequate spare parts inventory to provide both normal and emergency service.

5. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

6. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, must provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.

7. Provide all system programming to deliver a customized system to the Owner ready for use.

   a. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.

   b. System shall be reprogrammed three months after occupancy/system turn over to incorporate all Owner desired modifications.

8. Any system being extended or connected to an existing system shall be tested for full functionality prior to beginning work and at the completion.

G. Contractor Qualifications:

1. This Contractor shall be a certified installer for the proposed equipment/system manufacturer(s) and be BICSI certified ITS Installer 2, Copper and Optical Fiber and shall be certified to terminate indicated fiber connectors.

2. The cable installer shall provide documentation and references from three (3) similar installations installed within the previous two (2) years within a 60 mile radius.

3. Contractor shall be trained through the Panduit certification for horizontal cabling.

H. Installer Qualifications:

1. Cabling installer must have personnel certified by BICSI on staff.

2. Cabling installed shall be trained through the Panduit certification for horizontal cabling.

1.4 SUBMITTALS

A. Provide the following in a single clear and organized submittal. Package shall be submitted as specified in:

1. Manufacturers catalog sheets, specifications and installation instructions for all system components.

2. Detailed description of system operation.

3. Itemized list of all features and functions.

4. Dimensioned drawings of all system control cabinets and layouts for all equipment rooms.

5. Wiring diagrams showing typical connections for equipment.

6. Contractor certification and qualifications.

7. Riser diagrams showing all components, devices and interconnecting cable types.

8. List of three (3) installations of equivalent or larger systems that have been installed within the past two (2) years and have been operating satisfactorily for a minimum of one (1) year.

9. Warranty information.

10. System test reports.

11. Provide scaled elevation and plan drawings indicating walls, data racks, patch panels, wire management, cable trays, power strips, door swing, etc. for each cable closet/room.

1.5 SYSTEM DESCRIPTION

A. Provide a complete and fully operational state of the art Local Area Network (LAN) system as described herein and indicated on the contract documents. Include any and all interface equipment to supply a complete network with complete equipment connections necessary to form a complete "turnkey" network system as outlined in these specifications.

B. The complete system shall include, but is not limited to, the following:

1. Equipment Room build-out.
2. Telecommunications Room build-out.
3. Equipment cabinets and racks.
4. Patch panels and patch cables.
5. Wire management.
6. Horizontal cabling.
7. Fiber optic backbone cabling.
8. Modular jacks, backboxes and faceplates.

9. Terminations and testing.
10. Raceways, pathways, cable tray, sleeves, pull boxes.
11. Firestopping.
12. Training and system programming.

C. Owner shall provide the network electronics.

1.6 WARRANTY

A. All cable plant parts shall be warranted to the owner for a period of fifteen (15) years as a complete end-to-end system.

B. All network equipment shall be warranted to the owner for a period of one (1) year. Provide technical support at no charge to the customer for a period of one (1) year after system has been commissioned.

C. Make available an extended warranty to the customer.

D. Warranties shall commence upon final acceptance of the system.

E. Contractor to submit cable records to Panduit for warranty. Warranty shall be from Panduit and cover 25 years per Cornell University Division 270000 standards.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. Augmented Category 6A UTP Cable:

1. Initially, the manufacturer shall perform qualification tests on each cable. These tests shall be performed in accordance with the latest revision of ANSI/TIA/EIA 568-C.2 standard prior to shipment.

2. Date of Manufacture: Cable shall be a maximum of one (1) year old, from date of manufacture when installed.

3. Cable shall have a ripcord.

4. Cable shall be plenum rated, 4 pair, 100 OHM, 23 AWG.

5. Cable shall meet all requirements of FCC 68, the latest revision of the TIA/EIA 568B-C.2 and Addenda.

6. Cable shall have blue colored thermoplastic jacket with overall diameter not to exceed .215 in. x .240 in.

7. Pulling tension shall be rated for 25 pounds minimum.

8. Cable shall be able to withstand a minimum bend radius of 1.2 in. at -20ºC without insulation cracking.

9. Cable shall be color coded in accordance with the latest revision of the TIA/EIA T568B polarization sequence.

10. Cable shall not exceed maximum length of 90 meters.

11. Provide a printed report documenting testing based on ANSI/TIA 568-C.2 tested at 500 MHz. Testing parameters as follows:

    a. Less than 21.0 ohm per 100 m DC resistance.

    b. Return loss > 10.0 dB/100m at 500 MHz.

    c. Insertion loss < 43.8 dB/100m at 500 MHz.

    d. Near end cross talk (NEXT) > 26.7 dB at 500 MHz.

    e. Power Sum - near end cross talk (PS-NEXT) > 23.8 dB at 500 MHz.

    f. Attenuation to cross talk ration far end (ACRF) > 10.2 dB at 500 MHz.

    g. Power sum - attenuation to cross talk ratio (PS-ACRF) > 7.2 dB at 500 MZz.

    h. DC resistance unbalance between any two (2) conductors of any pair shall not exceed 3%.

    i. The capacitance unbalance of any pair to ground shall not exceed 65.6 pF per 100 meters.

    j. Delay < 490 ns at 100MHz.

    k. Delay skew < 44 ns at 100MHz.

    l. Cable shall be ANSI/TIA/EIA-568-C.2 augmented Category 6 (Cat 6A) compliant. The cable shall be tested and characterized by the manufacture to 500 MHz.

12. Acceptable Manufacturers:

    a. Panduit
    b. Prysmian / General Cable
    c. CommScope (Cornell Site-Specific)

B. Single Mode Fiber (Indoor/Outdoor):

1. Maximum Attenuation per KM:

    a. 1310 nM- 0.5

    b. 1550 nM - 0.5

2. 1310/1550 nM.

3. Shall be tight buffer, plenum rated, indoor-outdoor breakout style.

4. Core Type: Single Mode.

5. Core Diameter: 8.3 Microns.

6. Clad Diameter: 125 Microns.

7. Minimum bend radius shall be 20 times the diameter.

8. Strength members shall be FGE/Aramid yarn.

9. Shall meet requirements for plenum and vertical tray cable specifications of the NEC.

10. Provide number of fibers/cable as indicated in riser diagram on Drawings.

11. Shall have individual fiber tube colors per TIA/EIA-598 and an overall yellow jacket.

12. Acceptable Manufacturers:

a. Corning

2.2 PATCH PANELS

A. UTP Cable Patch Panels:

1. All panels should consist of a faceplate, mounting, hardware, isolation bushings, connector assemblies and labels for all ports.

2. Provide patch panels in each enclosure or rack to which the cable is to be terminated. Patch panels shall be of the type, performance and Category to match the cabling.

3. Patch panels shall be mounted in standard 19 in. racks/cabinets.

a. Contractor shall provide Panduit CJ6X88TG for Cat 6A terminations 48-port patch panels having wiring configuration specified with insulation displacement connectors on the back and 8P8C universal modular jacks on the front. No substitutions allowed.

b. Contractor shall provide quantity of patch panels to terminate all UTP cable. There shall be a minimum of 25% spare capacity for future installation.

4. Jacks shall be Panduit CJ6X88TG for Cat 6A terminations, T568A only. No substitutions allowed.

5. Panels shall have factory labels for each port.

6. All cables are to be terminated per EIA/TIA 568A standards and dressed in a neat workmanship way. Match the Owner's standard configuration.

7. Modular jacks shall be mounted on PC boards to offer low insertion and NEXT loss.

8. Provide grounding screw assembly with serrated head screw and manufacturer recommended connection to the associated rack.

9. Shall exceed EIA/TIA-568, UL1863 and FCC Part 68 performance specified.

10. Acceptable Manufacturers:

    a. Panduit CJ6X88TG for Cat 6A terminations.

B. Fiber Optic Patch Panels

1. Provide fiber optic rack mounted enclosure in where fiber optic cable is to be terminated.

2. Provide LC connector to match existing style panel base. Provide quantity of ports to terminate all strands of the fiber optic cable with additional 25% spare ports.

3. Shall mount in standard 19 in. rack and be constructed of 16 gauge steel and have gasketed openings and hinged door for easy access.

4. Provide wire management below and in rear of patch panel.

5. Patch panels to have modular ports with 12 minimum ports.

6. Acceptable Manufacturers:

    a. Corning

2.3 OUTLETS AND CONNECTORS

A. UTP Outlets/Connectors:

1. Physical Specifications:

    a. Shall be 8 position connector compatible with the cable characteristics.

    b. Shall be modular and snap-in to user configurable faceplates for future retrofits meeting durability requirements specified in the latest revision of the CEI/IEC standard.

    c. Shall be IDC type suitable for eight 22-24 AWG wires with a gas-tight connection.

d. Each contact surface shall have at a minimum, copper alloy with 50 micro-inches gold over nickel and a minimum contact force of 100g.

e. Conductors shall be separated and aligned internally by jack comb.

f. Shall have easy to read 568A/B color scheme to prevent termination errors.

g. Wired in accordance with TIA/EIA polarization sequence specified in Patch Panel section of this specification.

h. Transmission characteristics shall meet the requirements for the UTP cabling specified.

i. Minimum durability shall be 1000 connecting cycles.

2. Acceptable Manufacturers:

a. Panduit

B. Fiber Optic single mode Outlets/Connectors

1. Physical Characteristics:

a. Shall be LC type with insertion release mechanism.

b. Shall terminate up to 125 micron fiber.

c. Shall meet dimensional criteria of the latest revision of ANSI/EIA/TIA.

d. Typical outlet box shall be sized to insure minimum bend radius and store 1 meter of two strand fiber cable.

2. Transmission Characteristics:

a. Maximum loss of 0.3 dB per pair.

3. Splicing shall be by pigtail fusion as opposed to unicam connections.

4. Acceptable Manufacturers:

a. Corning

2.4 COLOR CODING

A. Cable outer jacket shall follow the color coding scheme as follows. Jacket color shall be continuous. Patch cords shall match the cabling.

B. Copper Cable:

1. Data Communication:

a. Category 6A - Green (Preferred)

1) Blue (if green is not available)

2. Voice Communication:

a. Category 6A - Green (Preferred)

1) Blue (if green is not available)

3. Wireless Network - Green (Preferred)

a. Blue (if green is not available)

C. Fiber Optic Cable:

1. Backbone Cabling:

a. Single Mode - Yellow

2. Horizontal Cabling:

a. Single Mode - Yellow

2.5 DISTRIBUTION ENCLOSURES/RACKS

A. All enclosure/racks shall be properly sized and of the proper quantity to house all of the required components and 25% spare space capacity. Provide grounding stud for each vertical rack.

B. Label each rack/enclosure designating it per the latest TIA/EIA standard:

1. Adhered plastic electronic printed label with 1/2" high lettering minimum.

2. Mount to top and bottom of each rack/enclosure.

C. Enclosed, Floor Mounted Cabinet:

1. Steel framed, smoked Plexiglas door with lock (keyed to the Owners standard), full length piano hinge and field adjustable swing.

2. Steel Rear Door with Lock (lower half vented).

3. Two (2) eight position vertical mounted power strips.

4. Fan Assembly - Suitable top mounted fans (two minimum) for an ambient temperature of 85°F.

5. Wire management brackets.

6. Adjustable front and rear mounting rails.

7. Adjustable 19 in. wide mounting rails. Depth to accommodate the intended equipment (32 in. minimum).

8. Color black.

9. Verify swing of door in the field prior to ordering.

10. Unit width shall accommodate racking, power strips and cable management.

11. In locations requiring two or more enclosures, side panels shall be removed and cabinets shall be bolted together allowing access between cabinets.

D. Open, Floor Mounted Racks:

1. Nominal size shall be 19 in. wide x 7 ft. high x 20 in. (minimum) deep. Rated for 2000 lb. minimum. Depth to match the intended equipment.

2. Rack shall be constructed of 6061-T6 aluminum extrusion, with EIA = 3 in. x 1.265 in. channel, 1/4 in. thick flange.

3. Provide base angles and top cross bars.

4. The back of rack shall have wire management panels and cable tray to wall.

5. Rack shall have baked enamel finish.

E. Enclosed, Wall Mounted Cabinet:

1. Standard 19 in. wide, 24 in. deep cabinet.

2. Height as required.

3. 16 gauge cold rolled steel.

4. Rack shall have locking front door.

5. Ventilated side panels.

6. Two (2) six position power strips.

7. Rack construction shall match freestanding.

8. Racks shall have dual piano hinges to allow access to front and rear.

9. Provide vertical and horizontal wire management.

10. Verify swing of door in field prior to ordering.

F. Floor Mounted Server Racks (Four Post Racks):

1. Racks shall have four vertical posts with top/bottom framing and be as specified above for open, floor mounted racks.

2. Racks shall be provided where shown on the drawings or identified in the equipment schedule.

G. Equipment Shelves:

1. Provide quantity of equipment shelves as indicated.

2. Shelves shall be made of .09 in. aluminum and shall support up to 30 lbs. on each side. All mounting hardware shall have baked enamel finish.

H. Acceptable Manufacturers:

1. Chatsworth
2. Mid-Atlantic
3. Great Lakes

2.6 CABLE MANAGEMENT

A. All racks are to be provided with cable management hardware to insure a neat, functional system when complete. Racks shall as a minimum, include the following:

1. PVC construction; duct fingers to manage cabling; color to match enclosure.

B. All racks shall have 8 in. wide vertical full height cable management, including cover, front and rear, on both sides of the rack.

C. All racks shall have 2RU space horizontal full width cable management, front and rear, above and below each patch panel and piece of equipment.

D. Cabinets shall have 1RU space horizontal panels, front and rear, above and below each patch panel and piece of equipment.

E. All data distribution frame plywood backboards shall be provided with vertical and horizontal wire management with capacities to house all possible future cabling and patch cords for a neat and orderly installation.

F. Acceptable manufacturers:

1. Panduit

2.7 INNERDUCT

A. Innerduct shall be corrugated HDPE material, plenum rated, flexible, continuous, UV rated with flame/smoke spread in accordance with code and length markings on the outer surface.

B. When in conduit minimum size shall be 3/4 in., otherwise 1 1/2 in. minimum.

C. Acceptable manufacturers:

1. Carlon
2. Maxcell
3. Opti-Com

2.8 LABELING

A. General:

1. Labeling system and structure shall match the Owners existing. System shall provide as built final conditions for each cable, port, panel, rack, etc. and utilize MS Excel or approved equal documentation. Provide hard and electronic copy of labeling documentation to the Owner as part of the O and M process.

2. Each label shall contain the Telecommunication Room designated, the room number and the port number in the room. Verify color of label and size of font prior to completion. Provide samples as requested.

3. Labels shall correspond to the room/names/numbers upon completion of the project. Contractor shall not necessarily utilize existing room/names/numbers or those indicated on the blueprints.

4. Label each rack and patch panel with 1 in. high lettering, black on white, adhered electronically printed plastic type label with labels at top, bottom, front and back.

5. Firestop used in vertical riser and horizontal conduit sleeves penetrating ceilings and floors shall be labeled. Provide and install labeling at each penetration including penetration type with UL listing used, material used, date of install, and name of installer.

6. All cables shall be labeled per InfoComm' s Standard "F501.01:2015 Cable Labeling for Audiovisual Systems". These labels shall match the labeling on the system as-built drawings.

7. All AV connection plate jacks shall be labeled with engraving or printed labels.

8. Cables pulled for future use shall be labeled as such.

B. Patch Panel

1. Individually label all patch panel ports. Port numbers shall match opposite end outlet/port number.

C. Outlets

1. Individually label all patch panel ports. Labels shall be installed in a workman-like manner and fit completely in the recessed area of the labeled location.

2. Contractor shall utilize adhered labels at poke-thru locations and any other locations that do not have a label location.

D. Cable

1. Fiber Optic:

a. Individually label fiber optic cables at each termination point indicating building, destination room, rack number, panel number, port number, strand number and strand color.

b. Each strand color shall match a specific fiber termination number in each closet, i.e. blue - fiber 1, orange - fiber 2, green - fiber 3, etc.

c. Cable label shall be adhered electronically printed plastic type with cable designation fully visible.

2. Copper

a. Specifically label cables at each termination point indicating the building, destination room, rack number, panel number and port number.

2.9 UTP CABLE TESTER

A. Contractor shall utilize Fluke DSX 5000 tester or approved equal. Provide adapters for specified cables. Turn over to owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable:

1. Provide a minimum of one horizontal UTP cable to each communication outlet jack from respective equipment/telecommunications room patch panel as called for. Quantity of data jacks equals minimum quantity of UTP cables (typical).

2. Provide a minimum of one (1) pair (2 strands) of single-mode fiber optic cable to each fiber jack from respective equipment/telecommunications room as called for. Quantity of fiber jacks equals minimum quantity of 2 strand cables (typical).

3. All risers, and wiring concealed in walls or soffits, shall be installed in metal conduits.

4. All cable above accessible ceilings shall be installed in cable tray or J-hook style cable rings 3 ft. O.C.

5. Provide wire management and Velcro cable wraps every 24 in. throughout closets.

6. Wiring/cabling shall be installed in accordance with the manufacturer's recommendations. If the manufacturer recommends larger wire sizes, they shall be provided. However, smaller sizes or lower cable categories are not acceptable.

7. All Contract Documents are schematic. The system supplier shall incorporate their wiring requirements on the system drawings. The Contractor in conjunction with the system manufacturer shall be responsible for complete wiring requirements and conduit sizes.

8. Install UTP cable in accordance with latest revision of TIA/EIA 568 standards.

9. The Contractor shall be responsible for replacing all cables that do not pass required bandwidth and throughput tests.

10. All raceways and closets shall be installed in accordance with latest revision of TIA/EIA-569.

11. All cables shall be labeled in accordance with latest revision of TIA/EIA 606 and these specifications.

12. All horizontal cables shall be terminated in patch panels at the distribution frames, and at the UTP jack at the telecommunications outlet.

13. Maximum length shall be 90 meters.

B. Terminations:

1. All terminations shall be made by a manufacturer's trained representative.

2. Use termination kits for fiber and UTP that are approved by the manufacturer of the cable.

3. All backbone cable shall be terminated in a patch panel and all connections between horizontal and backbone cables shall be through cross connect cable.

C. Equipment and Devices:

1. Install all devices where shown on drawings. Provide all necessary conduit outlet boxes, junction boxes, supports, etc. Verify all required box sizes with the system supplier and coordinate with bending radius needs. All devices shall be modular for future moves and changes.

2. Install all equipment in specified 19 in. racks/cabinets leaving minimum 30 in. of access space on sides and back of rack and 36 in. in front of rack.

3. Provide all power outlets and plug strips required for system operation but not shown on plans.

D. Raceways:

1. Minimum size raceway shall be 1 in.

2. Minimum backbox size for telecommunications outlet locations shall be two-gang with raised cover; no single-gang boxes allowed.

3. Provide no greater than 180° in bends or 100 linear feet without pull box in any raceway.

4. No flexible conduit raceways allowed unless explicitly approved by CIT.

E. Data Network Ground System:

1. Provide grounding system for all equipment rooms and telecommunication rooms as called for in Specification Section 260526.

F. Telecommunications Rooms:

1. Provide 3/4 in. x 4 ft. high continuous plywood backboard with two (2) coats of medium gray fireproof paint in telecommunications rooms.

2. Coordinate with other trades to avoid services being installed above telecommunications racks.

3.2 TESTING

A. Copper Cable: System supplier shall channel test end-to-end each permanent link connection using latest 500 MHz for Cat 6A 1000 Mbps IEEE testing procedure. Tester must conform to the latest standards at the time of testing not time of bid and be Fluke DTX-5000 with latest software version, or approved equal. Testing shall be performed by a technician trained with the specific testing equipment.

B. Fiber Optic Cable: Provide an OTDR test for all fiber optic cable and connections per latest IEEE and ANSI accepted procedures. Test shall utilize Fluke Opti Fiber Pro OTDR.

C. Replace any cables and connectors that do not meet or exceed standards referenced and stated herein and then tested. Testing shall be end-to-end / port-to-port for each cable.

D. Test equipment shall be in good condition and working order, calibrated within one year of its use and utilize leads without twisting and kinks. Unit calibration shall be in accordance with Level III Field Tester per ANSI/TIA 1152.

E. A representative of the end-user will select a random sample of 5% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing at no additional cost. Cables and connectors that do not pass shall be replaced and retested until acceptable results are obtained.

F. Test Reporting:

1. The field testing shall be accurately documented for submission, inclusion in O&M Manuals and for Owner future use.

2. Test reports shall include data directory table cross-referencing room numbers and cable numbers with the test report. Post copies of directory at telecommunications room location.

3. Report shall utilize electronic Windows based documenting with a hard and electronic copy provided to the Owner.

4. The report documentation for each cable test shall include the following as a minimum:

a. Project name.

b. Test equipment manufacturer and model number, and last calibration date.

c. Date and time of the test.

d. Patch panel identification.

e. Cable identification.

f. Cable type.

g. Pass/Fail: Pass indicating meeting or exceeding the identified criteria or standard (whichever more stringent) for all parameters. Fail indicating test not meeting identified criteria for one or more parameters.

h. Test pass criteria.

i. Cable length.

j. Propagation delay and attainable bandwidth.

k. List of tested parameters with test and allowable values. Any failed parameters shall be noted or highlighted.

5. Test reports shall be submitted to Panduit for the horizontal cabling warranty.

3.3 TRAINING AND INSTRUCTION

A. Provide brief overview of system of instruction to Owner personnel regarding system set up configuration and management. Training shall be sufficient for the Owner to understand the system operation, components, configuration, functions, testing and troubleshooting. All Owner questions shall be answered.

B. Training agenda (estimated duration, intent, specifications to be covered) shall be submitted for approval prior to the training. A finalized agenda shall be issued to the Owner and construction representative one (1) week minimum prior to the scheduled training. Owner's comments shall be incorporated and agenda redistributed prior to the training.

C. Two (2) hard copies and one (1) electronic (pdf) copy of the training materials shall be provided.

D. Provide updated cable schedule and redline/as-built during training and instruction period 2-3 weeks prior to occupancy.

3.4 WARRANTY

A. All cable plant parts shall be warranted to the owner for a period of fifteen (15) years as a complete end-to-end system.

B. All network equipment shall be warranted to the owner for a period of one (1) year. Provide technical support at no charge to the customer for a period of one (1) year after system has been commissioned.

C. Make available an extended warranty to the customer.

D. Warranties shall commence upon final acceptance of the system.

END OF SECTION

SECURITY AND ACCESS CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Card Access Systems

1. Wired: Card Access Systems (CAS), at the User End, are comprised of card reader, door contacts, electric hinge or power transfer (wired systems), door strike, latch, reader interface module, interconnecting power and communication wiring, head-end intelligent system controller. All systems, unless exempted from University policy, are centrally monitored transmitting data to and received by CUPD Access Control Services.

2. Wireless: Schlage AD400 – is comprised of an AD400 lockset, PIM400-1501 RSI wireless access point, LP-1501, communication wiring with power over Ethernet, and must be installed with an eight-cell battery pack. Every PIM must be installed with an external antenna. The series of AD400 installed must support a secure credential. Cornell IT policies must be adhered to when attaching devices to the University network.

1.2 SYSTEM OPERATION AND PERFORMANCE

A. System operation and performance shall include, but not be limited to, the following features:

1. Proper activation of door hardware when a valid credential is presented.

2. Appropriate shunting of the alarm upon exit from secured space.

3. Video signal being transmitted over IP.

4. Alarm initiation.

5. Trouble initiation.

6. Activation of alarm notification.

7. Activation of trouble notification.

8. Activation of fire safety functions.

9. Total supervision, monitoring of abnormal conditions in the system. 1

10. Activation of off-premise signals that are sent to the HDS via the Bosch Central Station (existing non-Access It! supported systems) or Ethernet (Access It! supported systems).

B. Activation of the fire alarm system shall cause the following:

1. Electric door hardware located on egress doors to lose power and allow egress/ingress where required by fire code.

2. Electrical door hardware mounted to a fire door must close and latch upon activation of the fire alarm system.

3. Delayed egress device must deactivate.

C. Activation of any security device producing an alarm or trouble shall cause, but not be limited to:

1. Transmission of the alarm or trouble signal to the Building ISC(s).

2. Transmission of the selected alarm or trouble signal to the Head-End Database Server (HDS).

3. Indication of the alarm or trouble condition at the computer monitor display at the CW, CPW, and HDS shall include the alarm or trouble description, time/date, building controller, device, input/output, priority code.

D. Activation of any card access device shall cause, but not be limited to:

1. Transmission of the data signal to the Building ISC(s) and HDS.

2. Indication of the data signal including the alarm or trouble description, time/date, building controller, device, input/output, card, and priority code by the computer monitor display at the CW and HDS.

E. Items C and D above define normal operations. In the event of a communication failure between an ISC and the HDS, these signals will be stored and forwarded to the HDS when the communication is restored.

1.3 CONTRACTOR REQUIREMENTS

A. The Contractor providing the security and access system shall be certified NICET Level II, and per Article 6d of the New York State General Business Law.

1.4 IDENTIFICATION

A. Provide lettered identification plates on the following equipment, components, and accessories (Note: Lettered identification plates shall be approved by Cornell University's Planning, Design and Construction Department prior to installation):

1. Building Intelligent System Controllers (ISCs);

2. Control Modules;

3. Interface Modules;

4. Remote Power Supplies.

B. Provide Lettered “Dyno 100” labels on system devices.

1. The label shall indicate the address and must be located on the device or adjacent to the device if this is not practical.

2. Cabling and devices terminating at the control equipment shall be appropriately labeled with the proper device number or device description. Terminal blocks that are active shall be labeled with their appropriate landing site on the terminal board.

C. Identification Plates and Labels shall be as follows:

1. DRIs shall be labeled DRI–UVWX, where U indicates its respective ISC numeral; and V is the ISC’s respective buss, a value from 1 to 4; where WX are values from 01 to 32.

2. Devices shall be labeled UVWXYZ, where U indicates its respective ISC numeral; and V is the ISC’s respective buss, a value from 1 to 4; WX indicates its respective panel, values from 01 to 32; Y indicates the input or output terminals, a value of 1 for input and 0 for output; and Z indicates its respective input or output terminal, a value from 1 to 4.

3. Examples:

a. DRI-2305 is the fifth Dual Reader Interface served from the third buss of the second Intelligent System Controller in the building.

b. Device #230503 is the device on the third output of the fifth panel served from the third buss of the second Intelligent System Controller in the building.

1.5 MISCELLANEOUS REQUIREMENTS

A. Equipment shall be mounted in a manner consistent with the ability to work around such equipment, and to perform the normal duties required in that area without coming into contact with the control equipment. Control equipment shall be mounted at a convenient height for future servicing.

B. Power transformers shall be mounted in such a way that shall prevent their disengaging, either by vibration, gravity, or an individual unplugging them.

C. Equipment enclosures shall have locking mechanisms that are left locked. Two keys shall be provided. One key shall be supplied to the Building’s Coordinator, and the other key must be supplied to Cornell Campus Police.

1.6 WARRANTY

A. Cornell University Department of Planning, Design and Construction’s (PDC) Sr. Electrical Engineer, and the Cornell Police shall approve security systems designs.

Coordinate the approval process with the Department of Planning, Design and Construction's Project Manager on capital projects and the Sr. Electrical Engineer on non-capital projects.

B. A final test of the respective security and card access equipment and hardware shall be performed prior to considering the installation to be "complete." Cornell's Sr. Electrical Engineer and Campus Police shall be notified two weeks prior to the completion of the installation of a tentative testing date. On that date, a full system test will be performed according to these guidelines.

C. The Campus Police will give a pass or fail to the system after the test has been completed. When a portion of the system fails during the test, that portion, or the entire test will be tested again. The extent of the retest shall be up to the discretion of Cornell's Sr. Electrical Engineer and Campus Police.

D. Cornell's Planning, Design and Construction Department shall accomplish the initial setup programming prior to the installation. A completed "Installation Checklist" for the facility shall be delivered and accepted by Cornell University's Sr. Electrical Engineer prior to the installation of the system and the actual system programming.

E. Cornell University's building coordinator, for the building implementing the security and access measures, shall supply Cornell University's Sr. Electrical Engineer with the information pertaining to the population residing within, and the traffic patterns and times of operation therein.

F. A warranty shall be provided for labor/workmanship and on hardware included in the installation, for a period of one (1) full year from the date of completion.

PART 2 - PRODUCTS

2.1 CONDUIT, WIRE AND BOXES

A. Communication conductors shall be shielded twisted pairs; #22 AWG (minimum) stranded copper between the ISC and each downstream device. Manufactured by Belden, model #6541FE or equivalent.

B. Low-voltage power conductors shall be unshielded twisted pairs; #18 AWG (minimum) stranded copper between the power supplies and each downstream device. Manufactured by Belden, model #6342FE, or equivalent.

C. Card reader conductors shall be a minimum of 22 AWG./8-conductor, shielded, between card reader and reader interface. Belden model #6563FE or equivalent.

D. Door position switch conductors shall be a minimum of 22 AWG./4-conductor between egress device and reader interface module. Belden model #6541FE or equivalent.

E. Electric locking hardware conductors shall be a minimum of 18 AWG./2-pair, twisted, shielded between head-end power supplies and each downstream device. Belden model #6342FE or equivalent.

F. Security and Card Access circuits and wiring shall be installed in a separate and independent conduit system from other system circuits.

G. System wiring, circuits, and conductors shall be color coded and identified by number at termination points (i.e., control panels, remote annunciators, etc.) and splice points (i.e., junction boxes, splice boxes, etc.).

H. Junction and splice boxes containing card access system wiring, circuits, and conductors shall have black covers and marked “SECURITY” in ¾" (three-quarter inch) white letters.

I. End-of-line resistors in shall be installed at the location of the door contact or other sensor, not at the ISC.

2.2 POWER REQUIREMENTS

A. Provide 120VAC power to the system power supply locations. Where available, provide a dedicated emergency power circuit. This power supply shall be permanently labelled at all equipment it feeds.

B. Provide 12VDC power supply for card access boards, and 24VDC power for other devices (crash bar, door hardware). Negative Reference of these power supplies shall not be used as an earth ground

C. Power supplies for door hardware shall be located in the same enclosure as the RIM serving that door or in adjacent enclosures at the same secure location previously approved by ACP and FMOPS alarm techs.

D. Power supply characteristics must be per hardware manufacturer’s specification.

E. Varying voltage supplies should be kept separate from each other.

F. Panel power supplies must be kept independent of all other components and should be connected to the power supply monitor on the panel where available.

G. Locking hardware should be directly wired to a distribution board; never a series.

H. Battery backup is required for all intrusion, video surveillance and card access systems must be replaced a minimum of every 3 years.

I. The Contractor shall provide power calculations, including load capability and maximum load per power supply, to Cornell Facilities Engineering during the submittal process and at the completion of the project.

J. Basis of Design:

1. LNL-OLSACTXP2

2.3 DOOR HARDWARE

A. Refer to Division 8 for responsibilities.

B. New door installations, opening hardware must conform to the current Americans with Disabilities Act guidelines; either lever set, flip paddle, panic paddle or crash bar hardware is acceptable.

C. Hinges on reverse beveled doors shall be non-removable pins (NRP).

2.4 ELECTRONIC LOCKING HARDWARE

A. Refer to Division 8 for responsibilities. Division 26 shall coordinate electrical requirements with Division 8 specifications and plans.

B. Use of magnetic locking hardware, electric strikes and standalone keypad locks is not permitted without obtaining an exemption from FM Operations Lock Shop Technician, CUPD Access Control and the Director of Risk Management.

C. Electronic hardware in the building shall use one standard voltage. Applications shall operate on 24VDC voltage. Deviations from this voltage are unacceptable without prior written consent by the University's FM Operations Fire/Alarms & Security Technician and FM Operations Lock Shop Technician. Existing electronic hardware that is not feasible to replace is an acceptable reason to deviate from this voltage. In applications where the latch bolt of the locking mechanism can be accessed from the outside of the door, a latch guard, or astragal, must be installed over the locking mechanism to prevent retraction of the latch bolt, allowing release of the door to an open condition.

D. Electronic locking hardware must be installed in a fail-secure configuration.

E. Delayed egress devices must release to an unlocked position on any fire alarm activation where required by local fire or building codes.

F. Fail-Safe operation will be permitted only in instances where dictated by local fire or building codes.

G. On fire rated doors, latch retraction mechanisms must release to latched position and magnetic door hold open devices must release upon receipt of a signal from the building fire alarm system.

H. For electric strike configurations, the strike must be installed in a flush-mounted configuration, properly adjusted to allow the anti-tamper mechanism on the lever set to be engaged. Surface-mount configuration will be allowed where warranted by the door configuration (i.e. concrete filled jamb) or by the hardware configuration (i.e. mechanical crash-bar).

2.5 INTELLIGENT SYSTEM CONTROLLERS (ISCs)

A. General

1. The project is responsible to pay the costs associated with providing the dedicated TCP/IP network connection to each ISC location. Request for data must be submitted by the end user or Project Manager at a minimum of two weeks prior to installation. Request should include project account number and monthly billing number. Access Control Program to provide VLAN information.

2. Use of existing or single Intelligent System Controller (ISC) is preferred. Multiple ISCs are acceptable when specifically requested by the customer or approved in design by the CUPD Access Control Project Management team.

3. The integrated system including equipment, components, and accessories shall be UL listed for the purpose for which the equipment, components, and accessories are used.

B. Enclosures

1. Enclosures shall be of the 22 ga. heavy-gauge, galvanized steel, dead-front construction with keyed, lockable panel cover type.

2. FM Operations Fire/Alarms & Security Group must approve panel locations. High Security installations shall have ISC's installed inside the high security space or be located in another secured location and have unique cabinet locks where the ACC is in possession of the keys.

3. All panels must have tamper switches on the enclosure wired to the cabinet tamper inputs on the controller board.

C. Intelligent System Controller Modules:

1. Host communications shall be direct wire TCP/IP, flash memory for real-time updates, with a minimum of 16MB onboard memory expandable to 64MB. The TCP/IP is over Ethernet at a minimum of 100mbps.

2. Supports up to eight different card formats, with issue code support for both Wiegand and magnetic formats.

3. Will support at least 64 readers or 32 downstream devices, and minimum 100,000 cardholders, 255 access levels, 255 Holidays with grouping, 255 time zones, each with 6 time intervals.

4. Alarm Masking, Individual shunt times, available 6-digit pin code.

5. Two dedicated inputs for tamper and power failure status.

6. Manufacturer: Access It! LP-2500, Access It! LP-1502 or Access It! LP-1501. (Use the Access It! LP-1501 only for Schlage AD400).

2.6 INPUT CONTROL MODULES

A. General

1. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

2. Two inputs are available for cabinet tamper and power fault monitoring. Normally, the contacts are closed. Power fault monitoring should always be in place. The cabinet tamper may be shorted if not necessary.

3. Alarm inputs shall be supervised with end-of-line resistors that are 1000 ohm, 1% tolerance.

4. The Input Control Modules are intended for low voltage, class 2 circuits only.

B. Cabinet: Refer to ISC requirements for Input Control Module cabinet requirements.

C. Input Control Module:

1. Line supervision, with 12VDC power supply.

2. RS-485, 4-wire communications.

3. Sixteen programmable supervised input contacts (use end-of-line resistors).

4. Two form-C 5A, 30VDC contacts for load switching with contact protection.

5. Two dedicated inputs for tamper and power failure status.

6. Manufacturer: Access It! MR-16IN or Access It! MR-16OUT.

2.7 OUTPUT CONTROL MODULES

A. General

1. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

2. Two inputs are for cabinet tamper and power fault monitoring.

3. Contact protection shall be used to minimize premature failure of the contacts and to increase system reliability.

4. The Output Control Modules are intended for low voltage, class two circuits only.

B. Cabinet: Refer to ISC requirements for Input Control Module cabinet requirements.

C. Output Control Module

1. Line supervision with 12VDC power supply.

2. RS-485, 4-wire communications.

3. Sixteen form-C 5A, 30VDC contacts for load switching that support “on”, “off”, and “pulse” control.

4. Two dedicated inputs for tamper and power failure status.

5. Manufacturer: Access It! MR-16OUT.

2.8 SINGLE READER INTERFACES (SRIs)

A. General

1. Dual Reader Interfaces (DRI) are preferred whenever possible due to greater functionality and expansion potential. See section 2.13 below.

2. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

3. Two supervised inputs are for exit request (normally open) and door contact (normally closed) monitoring.

4. Alarm inputs shall be supervised with end-of-line resistors that are 1000 ohm, 1% tolerance.

5. Two output relays support fail-safe and fail-secure operation. One relay shall be used for the strike (locking device) and is capable of 5A; the other relay may be used for auxiliary functions and is capable of 1A.

6. Provide end-of-line termination at the end of the communications line. If the Single Reader Interface is at the end of the RS-485 line, the J4 termination jumper must be set.

B. Power

1. Provide a 12VDC, 125mA power input.

2. 80mA is available from Single Interface Reader for reader TTL power.

3. Circuit with 18AWG (minimum) twisted pair cable.

C. Upstream Communication

1. Port 1, using 2-wire RS-485 interface, is used to communicate with the Intelligent System Controller.

2. RS-485 interface cable shall be a minimum 24 AWG twisted shielded pair.

3. Cable drops to devices from the Single Interface Reader should be kept to a minimum. Drops should not exceed 10 feet.

D. Manufacturer: Access It! MR-50

2.9 DUAL READER INTERFACE MODULES (DRIs)

A. General

1. Locate its respective power source as close as physically possible, while maintaining proper service clearances.

2. Eight supervised inputs, four per door. Inputs per door are for exit request (normally open), door contact (normally closed), and two auxiliary monitoring points (selectable through the software).

3. Alarm inputs shall be each supervised with two end-of-line resistors that are 1000 ohm, 1% tolerance for a total of 2000 ohms.

4. Six output relays support fail-safe and fail-secure operation. All six relays are capable of 5A apiece. Relays per door are for the strike and two auxiliary relays.

5. Provide end-of-line termination at the end of the communications line. If the Dual Reader Interface is at the end of the RS-485 line, the J5 and J6 termination jumpers must be set.

B. Power

1. Provide a 12VDC, 450mA power input.

2. 80mA is available from Dual Interface Reader for reader TTL power.

3. Circuit with 18AWG (minimum) twisted pair cable.

C. Upstream Communication

1. Port 1, use 2-wire RS-485 interface, used to communicate with the Intelligent System Controller.

2. RS-485 interface cable shall be a minimum 24 AWG (minimum) twisted shielded pair.

3. Cable drops to devices from the Dual-Interface Reader should be kept to a minimum. Drops should not exceed 10 feet.

D. Manufacturer: Access It! MR-52.

2.10 IDENTIFICATION

A. Provide lettered phenolic identification plates on the following equipment, components, and accessories as noted below:

1. Building Intelligent System Controllers (ISCs)

2. Control Modules

3. Interface Modules

4. Remote Power Supplies

5. Provide computer-generated adhesive labels on system devices (Brady, Dymo, P-Touch). The label shall indicate the address and must be located on the device or adjacent to the device if this is not practical.

B. Cabling and devices terminating at the control equipment shall be appropriately labeled with the proper device number or device description. Terminal blocks that are active shall be labeled with their appropriate landing site on the terminal board.

C. System Labeling and Identification

1. The description in the notes field of the Access It! access control system shall indicate the location of the ISC's, DRI's, power supplies, PIM's, SRI's, and Video devices and include the date of installation.

2. The location shall include the room number and geographic location in the room itself.

D. Identification Plates and Labels shall be as follows:

1. ISCs shall be labeled ISC–U, where U is a value from 1-9.

2. DRIs shall be labeled DRI–UVWX, where U indicates its respective ISC numeral; and V is the ISC's respective buss, a value from 1 to 4; where WX are values from 01 to 32.

3. Devices shall be labeled UVWXYZ, where U indicates its respective ISC numeral; and V is the ISC's respective buss, a value from 1 to 4; WX indicates its respective panel, values from 01 to 32; Y indicates the input or output terminals, a value of 1 for input and 0 for output; and Z indicates its respective input or output terminal, a value from 1 to 4.

4. Examples

a. ISC-2 is the second Intelligent System Controller in the building.

b. RIM-2305 is the fifth Dual Reader Interface served from the third buss of the second Intelligent System Controller in the building.

c. Device #230503 is the device on the third output of the fifth panel served from the third buss of the second Intelligent System Controller in the building.

PART 3 - INSTALLATION

3.1 CABLE AND RACEWAY SYSTEMS

A. Provide communication system requirements for a fully operational card access system.

B. Installations shall be performed to the current code requirements.

C. Cables shall be routed in raceway systems. Free air, plenum rated cable is not acceptable.

D. Raceway systems shall be installed in a concealed manner; they shall be brought in above an accessible ceiling and fished inside the walls. Surface raceway systems are permitted where ceilings are inaccessible and walls cannot be fished.

E. Cabling shall be run in such a fashion so as to be kept at least 18" away from electric or data lines. In the event that a cable must cross over the path of an AC line, the cable must cross the path at a 90-degree angle to the AC line, thus keeping EMF interference to a minimum. Cabling must be kept at least 18" away from fluorescent lighting ballasts. Wiring installed in door frame components shall be installed to protect from damage and allow for future repairs or upgrades.

F. Cornell University Facilities Engineering (FE) must approve any deviations in wire, raceway systems, or raceway hardware.

G. Raceways shall be run from the field device to the head-end termination point in a professional manner, utilizing conduit, beam clamps, wire ties or other devices where necessary. In areas where the raceways are to be run above the drop ceiling, conduits shall be routed together where possible. Routing shall be in a workmanlike manner, with raceways mounted so as not to interfere with the servicing of other building infrastructure systems in the future. Electrical work shall conform to the latest local codes and the National Electric Code (NEC).

H. Specifications for Ethernet cabling: 1

1. All cable should comply with CIT cabling standards, be full copper and a minimum rating of CAT6. CCA (Copper Clad Aluminum) cabling shall not be used.

2. All cabling should adhere to current NFPA and NEC requirements for power over Ethernet.

I. Communication conductors shall be shielded twisted pairs; a minimum 24 AWG./2- pair stranded copper between the ISC and each downstream device. Manufactured by Belden, model #9842 or equivalent.

J. Adequate conductors shall be provided to allow for all functions the equipment is capable of providing regardless of use at the time of installation.

K. Low-voltage power conductors shall be unshielded twisted pairs; a minimum 18 AWG./4-conductor stranded copper between the power supplies and each downstream device. Manufactured by Belden, model #9157, or equivalent.

L. Card reader conductors shall be a minimum of 22 AWG./6-conductor, shielded, between card reader and reader interface. Belden model #9942 or equivalent.

M. Door position switch conductors shall be a minimum of 22 AWG./2-conductor between egress device and reader interface module. Belden model #8442 or equivalent.

N. Electric locking hardware conductors shall be a minimum of 18 AWG./2-conductor, between head-end power supplies and each downstream device. Belden model #8461 or equivalent.

O. System wiring, circuits, and conductors shall be identified by number at termination points (i.e., control panels, remote annunciators, etc.) and splice points (i.e., junction boxes, splice boxes, etc.).

P. Junction and splice boxes containing card access system wiring, circuits, and conductors shall have blue covers.

Q. End-of-line resistors shall be installed at the location of the door contact or other sensor, not at the ISC.

3.2 MOUNTING REQUIREMENTS

A. Equipment shall be mounted per manufacturer installation instructions and in a manner consistent with the ability to work around such equipment, and to perform the normal duties required in that area without coming into contact with the control equipment.

B. Control equipment shall be mounted at a convenient height for future servicing. Control equipment shall be mounted in such a way that shall prevent their disengaging, by either vibration, gravity, or an individual unplugging them.

C. Control equipment shall have at least 4 inches of clearance from any non-system component or structure, unless mounted adjacent to another access control panel.

D. Power transformers shall be mounted in such a way that shall prevent their disengaging, by either vibration, gravity, or an individual unplugging them.

E. Existing Equipment shall not be connected to, modified, or otherwise tied into without approval from FMOPS Alarm Techs prior to installation start.

3.3 SYSTEM PROGRAMMING – CARD ACCESS

A. Cornell's Access Control Program (ACP) will perform the initial setup programming prior to the installation.

1. Facilities Fire Alarms & Security Technician or a Access It!-certified installer will perform all required wiring and terminations on the board prior to ACP configuration.

2. ACP will perform initial setup programming to include:

a. ISC configuration and labeling.

b. Device hardening.

c. User/Password configuration

d. Creation of the device instance in the access control software.

e. Creation or modification of the Emergency Response access level using the following naming convention (EMERGENCY RESPONSE – Segment Name).

3. Facilities Fire Alarms & Security Technician or a Access It!-certified installer will:

a. RIM (reader interface module) configuration and labeling.

b. Initial test Time Zones and Access Levels.

c. Initially name devices: Facility Name, Room number, Room purpose, compass direction of installation, Interior or Exterior

B. The building/unit access control coordinator (ACC), for the building implementing the security and access measures, shall supply CUPD Access Control Project manager with the information pertaining to the desired theory of operations for the space including population residing within, and the traffic patterns and times of operation therein. If it is determined that the authorized ACC's are failing to comply with policies or misusing the system, their privileges may be revoked.

C. The security system installer is responsible for initial alarm programming and commissioning for intrusion devices with approval and collaboration of Cornell Police Telecommunications and CUPD Crime Prevention.

3.4 TESTING, COMMISSIONING AND ACCEPTANCE

A. A final test of the respective security and card access equipment and hardware shall be performed prior to considering the installation "complete". In the case of a new building or renovation, this shall be done prior to building occupation.

B. As-Builts shall be provided to FMOPS Alarm Group prior to commissioning

C. Installation's project and/or construction manager shall schedule a systems commissioning with the Access Control Project Management team, Security Contractor/Installer, and Electrical contractor, preferable to have the actual installing employee on site if possible, when applicable, two weeks prior to the completion of the installation of a tentative testing date. On that date, a full system test will be performed according to these guidelines.

D. The CUPD Access Control Project Management team will give a commissioning report to the project manager after the test has been completed. When a portion of the system fails during the test, that portion, or the entire system will be tested again. The extent of the retest shall be up to the discretion of Access Control Project Manager.

E. If occupation occurs prior to Access Control commissioning, the Cornell Project Manager is responsible for obtaining CUPD approval and building occupants must be notified of potential security risks (by flier, email via the Unit/College department).

3.5 WARRANTY

A. A warranty shall be provided for labor/workmanship and on hardware included in the installation, for a period of one (1) full year from the date of completion.

3.6 PROJECT CLOSE OUT

A. At completion of the project, the Contractor shall provide the Cornell Project Manager with a complete set of security system “As-Built” drawings that includes, but is not limited to, the following information prior to the closeout of the project.
The project manager will ensure these documents are delivered to Facilities Inventory Group for archiving.

1. Head end equipment location and interface panel locations.

2. Power supply locations.

3. Battery calculations.

4. Device locations.

5. Circuit breaker locations: Include power panel and circuit numbers.

6. Complete system riser diagram that depicts all wiring, components, and interconnections. Include locations and labeling

END OF SECTION

ANALOG ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials, equipment and services to perform operations required for the complete installation of a fully operational analog addressable fire alarm system and related Work as described in the Contract Documents.

B. Provide system as approved by local Fire Marshal and the Authority Having Jurisdiction (AHJ). System materials and installation shall be in accordance with the manufacturer's recommendations.

1.2 QUALITY ASSURANCE

A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

B. Installation shall be in accordance with NFPA-70 (National Electrical Code), NFPA-72 (National Fire Alarm Code), AHJ, state codes, local codes, requirements of authority having jurisdiction and the contract documents. Installer shall be certified in the State of New York for fire alarm installation.

C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published UL, NFPA, ANSI, NEMA and IEEE Standards. All system equipment shall be compatible and of the same manufacturer.

D. Each item of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer and shall bear the UL Label.

E. System installation shall be under the supervision of an accredited factory representative. Final connections to the FACP, annunciator panel and any other panels shall be by the factory representative.

F. The system provider must:

1. Provide equipment from a single manufacturer for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.

2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years minimum.

3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day, 365 days per year and staff must be adequate to respond within 2 hours of an emergency call.

4. Have a service location not more than 50 miles from the project location.

5. Maintain adequate spare parts inventory to provide both normal and emergency service.

6. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.

7. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment

8. Provide all system programming to deliver a customized system to the Owner ready for use.

9. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.

10. Provide a minimum of two system inspections/tests each year during the warranty period as described in NFPA 72. Needed and requested system programming changes shall be provided at these times.

11. Warranty period shall be as described elsewhere with two years being minimum. Provide a service contract for the Owner review for two years beyond the warranty period. Warranty shall include all parts, materials, labor, transportation, etc.

12. Any system being extended or connected to an existing system shall be tested for full functionality prior to beginning work. System shall be signed off by Owner/Engineer as fully functional prior to any new work.

1.3 SYSTEM DESCRIPTION

A. The system shall constantly monitor all initiation devices and notification circuits for any abnormalities or alarm conditions. System shall sample/poll each addressable device no less than every 10 seconds.

B. The system operation subsequent to the alarm activation by any initiating device (manual station, automatic detector, sensor, sprinkler flow switch, etc) shall be as follows:

1. All audible alarm notification appliances within corresponding building or designated area shall provide a common audible fire alarm signal until the System Reset Key or the Signal Silence Key is depressed.

2. All visual alarm notification appliances shall flash continuously and synchronized until the system is reset or silenced.

3. The offsite central monitoring station shall be notified automatically until the System Reset Key or the Signal Silence Key is depressed. The municipal box shall be activated notifying the fire department.

4. Shutdown of the corresponding HVAC system equipment shall occur with a supervisory alarm until the system is reset. All fans over 2000 cfm shall be shut down.

5. Activation of all programmed outputs assigned to the initiating device shall occur until the system is reset or the silence key is depressed.

6. The alarm shall be displayed at the local Fire Alarm Control Panel (FACP) and the fire alarm annunciator panel. A printout shall be produced at the FACP.

7. The system alarm LED shall flash on the control panel and the fire alarm annunciator panel until the alarm has been acknowledged/reset. Once acknowledged, this same LED shall latch on. A subsequent alarm received shall flash the system alarm LED on the control panel and annunciator. The LCD display shall show the new alarm information.

8. A pulsing audible alarm tone shall occur within the local building control panel and, where applicable, the fire alarm annunciator panel until the event has been acknowledged.

9. Alarms shall be entered into the system event log history.

C. Any subsequent alarm shall follow the operation described above.

D. The activation by any system smoke detector or sensor shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within a preset time after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within the prescribed time, the system shall resume normal operation. The alarm verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by device.

E. A manual evacuation (drill) switch shall be provided to operate the alarm notification appliances without causing other control circuits to be activated. However, should an actual alarm occur, all alarm functions shall occur as described previously.

F. The system shall have a password(s) to allow the operator to display all alarms, troubles, and supervisory service conditions log history including the time of each occurrence. This shall be able to be viewed from the front of the control panel, annunciator panel or from a computer connected to the FACP.

G. The actuation of the " walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:

1. The remote central monitoring station connection shall be bypassed.

2. Only audible and visual appliances shall be operated. Other alarm functions (elevator recall, HVAC shutdown, etc.) shall not be affected.

3. Walk test shall be selectable by circuit or circuits.

4. Actual alarms received during a "Walk Test" shall cause the control panel to go into alarm and override the walk test mode.

5. The control panel shall show trouble conditions.

6. The walk test activation of any initiation device shall cause the audible signals to activate for two seconds or a distinguishable audible.

7. The panel shall automatically reset itself after signaling is complete.

8. The control panel shall automatically return to normal condition if there is no activity on a walk test circuit for a period of 30 minutes.

H. Any momentary opening of an initiating or notification appliance circuit wiring shall cause an audible signal to sound at the Fire Alarm Control Panel and, where applicable, the annunciator panel for four seconds indicating a trouble condition.

I. Elevator Operation:

1. Provide the following equipment as a minimum and as indicated on the drawings:

a. Smoke detection in the elevator equipment room.

b. Smoke detection at each elevator lobby.

c. Smoke detection in the elevator shaft if a smoke hatch.

d. Heat detection in the equipment room and shaft (high and low) if a sprinkler system is in the area. Detectors shall be within 2' of the individual sprinkler heads.

e. Detection devices located in elevator lobbies, elevator hoistways and elevator machine rooms shall be used for elevator recall. Hoistway and equipment room heat detection shall initiate power shut down prior to water flow. Operation shall be in accordance with ASME A17.1, Safety Code for Elevators and Escalators.
Signals shall be provided to the elevator controls for main level lobby alarm, any lobby alarm, elevator equipment room alarm and elevator hoistway alarm as a minimum. Provide addressable control modules for the signals to the elevator controls.

J. Alarm initiation of a detector associated with a smoke hatch or fire barrier shall initiate a system alarm. Also, provide connections between the auxiliary contacts on the detectors or addressable control module and the associated smoke hatches and fire barriers such that the smoke hatch or fire barriers will be operated upon its respective detector activation. Provide power supplies, wiring and accessories for fire alarm system and all supervisory functions required for proper smoke hatch and fire barriers operation.

K. Duct mounted smoke detectors associated with duct dampers shall have an addressable control module to operate the duct damper. In the event of an alarm initiation by the duct mounted smoke detector or the associated air handling unit/fan shut down the duct damper shall be closed. Control wiring shall be provided to shut the damper(s) when the associated air handling unit is not operational. Provide power supplies, wiring and accessories as needed for this operation.

L. Provide wiring and equipment such that alarm initiation of a heat detector located in the elevator machine room and/or the elevator shaft shall provide suitable voltage from the fire alarm control panel to be applied to the shunt trip coil of the elevator's supply circuit breaker. No fire alarm devices except the heat detectors in the elevator machine rooms and shaft shall cause this. Also, alarm initiation of these heat detectors shall initiate the system alarm functions described above. Provide an addressable control module with a Form C contact at the elevator controllers, which shall be normally closed and shall open upon alarm initiation of any of these heat detectors; this contact shall be used to disconnect the battery-powered emergency return unit if so equipped with the use of a relay suitable for the emergency power circuit. Also, provide an auxiliary contact on the main line disconnect switch (four pole unit) and two (2) #12 in conduit to the elevator controller from this contact for the same purpose.

M. Provide a minimum of two Form C contacts at the building's fire alarm control panel. This contact shall activate upon activation of any fire alarm initiating device.

1.4 SUPERVISION

A. The system shall utilize independently supervised initiation device circuits. The alarm activation of any initiation device shall not prevent the subsequent alarm operation of any other initiation device.

B. Notification appliance circuits shall be supervised to indicate an open or short circuit condition.

C. The incoming power to the system shall be supervised so that any power failure must be audible and visually indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present. This shall be a trouble alarm.

D. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and the remote annunciator. This shall be a trouble alarm.

E. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.5 SUBMITTALS

A. Provide a complete system submittal prior to ordering of equipment and installation including but not limited to:

1. Complete equipment list, including quantities.

2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.

3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.

4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting, control circuiting and any system applicable building characteristics (ceiling heights, structural members impeding detection, etc). Contact the Engineer for an electronic copy of the project floor plans. Engineer logo shall be included in final drawing.

5. Typical Terminal Wiring Diagram for each type of device.

6. Terminal wiring Diagram for all Fire Alarm equipment.

7. Calculations including:

a. Battery sizing calculations indicating total number of power devices, load associated with each type device, backup period and recommended battery capacity (AH).

b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.

8. Complete console enclosure and equipment configuration.

9. Contractor shall submit copies of the installation firms license for approval and post a copy of license on the premises where the work is being performed.

a. Work involving installation of Fire Alarm system components shall be performed by firms currently licensed by the NYS department of State Division of Licensing Services. The supervising personnel shall be NICET level 2 certified.

10. Test reports as called for.

11. Copies of the firm alarm installation firm's current license. The contractor shall also post a copy of the license on the premises where work is being performed.

B. If required by the Authority Having Jurisdiction (AHJ) provide a submission of all requested information for review and comment by the AHJ. All AHJ comments shall be incorporated and resubmitted until approved.

C. Test reports at the completion of the project. Testing shall be of all system devices, equipment, circuits, features and functions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The project fire alarm system shall comply with and be in accordance with the drawings and specifications. All system equipment and materials shall be of the same manufacturer unless otherwise indicated. System and component acceptable manufacturers include the following unless otherwise indicated:

1. FCI E3 (Preferred)

2.2 FIRE ALARM SYSTEM

A. The fire alarm system shall be comprised of the components specified as a minimum and also include components not indicated but required for a complete and operable system as described herein.

B. The system and all its components shall be UL listed and in accordance with NFPA 72, local and state codes.

C. The system shall have 25 % spare capacity. This shall include all individual notification circuits, initiation circuits, initiating modules, alarm modules, power supplies, batteries, central processing unit memory and printed circuit card space. System initiation device and control device capacity shall be a minimum of the indicated percentage over the shown quantity or 250 whichever is greater.

D. Each initiating device shall have an individual address for system communication. The system addresses shall not exceed seven digits. Each address, initiation circuit, notification circuit and control point shall have an individual identification description.

2.3 FIRE ALARM CONTROL PANEL (FACP)

A. The system shall be entirely solid state, microprocessor based, use digital transmission and shall be field programmable. All system programming including field modifications shall be stored in non-volatile memory. Field modifications shall be automatically stored without special actions. The panel shall be designed and manufactured expressly for the intent to detect the presence of fire and to provide indication of such detection. Panel shall contain as a minimum power supply(s), control module, main control printed circuit board, initiation modules, notification modules, terminals and back up battery(s). Control module shall have 80 character backlit LCD display and twelve control buttons (four being field assignable), minimum. Display shall indicate the battery voltage at all times.

B. The system shall be modular in design to allow for future expansion with a minimum of hardware additions.

C. The FACP shall be located where shown on the drawings. Enclosures shall accept all system items for an aesthetically suitable operator's console. Enclosures shall be of modular size to allow surface mounting of multiple boxes adjacent to each other, shall have hinged solid metal doors and contain a lock with a key common to all system devices. Enclosure shall have a red finish.

D. Conditions of the system shall be indicated at the operator interface by LED's. These conditions shall be alarm, supervisory, trouble and alarm silenced. An LCD 2 line, 40 character per line display shall also be included. It shall display "SYSTEM IS NORMAL" with the date and time under normal circumstances. The LCD display shall also indicate type of alarm, point status, number of alarms and location. Through the use of function keys, historical data can also be displayed.

E. The FACP shall include a password (three levels of protection with individual passwords, minimum) protected key pad for access to programming, special functions and all system features.

F. Any event initiated by the FACP due to an alarm input shall be retained in nonvolatile EPROM memory. The FACP shall also have sufficient memory for 1200 individual alarm/trouble events.

G. The FACP shall have the following user connection types:

1. Ethernet connection for a computer, personal data device or printer. Connection shall allow for programming changes, history download, setting review/changes, etc.

2. RS 232 port for connection of a serial printer.

H. Provide modules for network interfacing.

I. The FACP shall be equipped with a minimum of 4 hours of battery standby. The FACP shall be equipped with battery charging circuits sufficient to recharge fully depleted batteries to within 70% of the maximum capacity within 12 hours. When the system is operating on the battery supply, a trouble condition shall be generated.
When utility power is restored, the system shall revert back to 120 VAC supply without any operator intervention.

J. Design Equipment: FCI E3

2.4 REMOTE TRANSPONDER UNIT (RTU)

A. The RTU shall function as a subpanel to the FACP, and shall have all the initiation, notification, control, battery, display functions, etc. as the FACP. In the event of failure of the FACP the RTU shall continue to function as a standalone system. All remote notification shall be through the FACP. Provide power circuits to the RTU similar to the FACP. The spare capacity indicated for the FACP shall also be provided in the RTU's. All trouble and alarm conditions at the RTU shall be transmitted to the FACP for suitable operation.

B. RTU's shall contain their own processors and memory and function independently of the FACP but utilize the same base programming. Programming functions in the RTU shall be accessible through the FACP and RTU.

C. The RTU shall be capable of communication with addressable devices that are uniquely identified by an address. Wiring shall be shielded twisted pair cable. The system must allow up to 2,500 feet wire length to the furthest addressable device. T-tapping of the communications channel or multiple loop channels shall be supported.

D. Enclosures shall be of modular size to allow surface mounting of multiple boxes adjacent to each other, shall have hinged solid metal doors and contain a lock with a key common to all system devices.

E. The FACP shall communicate with RTU's through dual supervised data lines. Data lines shall be standard #18 AWG twisted shielded pair minimum or as recommended by the manufacturer. In normal operation, each line shall be used alternately on intervals to maintain line integrity. Should either data line fail, system shall automatically revert to alternate data line and data line trouble shall be reported to operator. The FACP shall automatically "re-boot" after data line is restored. Minimum allowable distance between the FACP and RTU shall be 2500'.

F. Design Make: FCI E3 FACP.

2.5 VENTILATION FAN SHUTDOWN CONTROL

A. Provide supervised normally closed relays and contactors for connection into the fan motor control circuits ahead of all automatic devices.

B. Sequence fan shutdown for every air distribution system. Provide duct detectors in return of systems over 2,000 cfm and in both supply and return at each floor of systems over 15,000 cfm.

C. Provide drill bypass feature, locate switch on Fire Alarm Control Panel and label "DRILL-FAN SHUTDOWN BYPASS". Buzzer shall sound continuously while in bypass mode.

D. Provide fan reset feature, locate switch on Fire Alarm Control Panel and label "FAN RESET".

2.6 INITIATION DEVICES

A. General:

1. Provide analog addressable smoke and thermal sensors as shown. All detectors, control modules, monitor modules and all other initiation devices shall communicate with twisted pair cable and have an individual address. Peripheral devices shall be of the some manufacturer as the FACP.

2. Spot type detectors shall utilize the same interchangeable bases.

3. If a device is removed or taken out of service a trouble signal shall be initiated.

B. Photo-Obscuration Type Smoke Detector:

1. The photo-obscuration detector shall operate on the photo electronic principle and provide an analog signal to the system indicating the amount of smoke. Detector shall be an analog addressable type.

2. The detector shall incorporate a built in type identification so the system can identify the type of detector. The sensor shall be continually monitored to measure any change in their sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). Unit shall not be affected by exterior light or EMF.

3. The detector shall be designed and arranged to prevent interference from exterior electromagnetic fields and light.

4. The detector shall provide advance indication of the analog value of the products of combustion to the FACP indicating that maintenance is required in order to insure normal operation. The detector sensitivity shall be adjustable per device (within UL limits) and be set at the FACP for continuous or variable based on time of day. There shall be a minimum of six selectable sensitivity levels. The individual detector sensitivity setting shall be adjusted to meet the building/space characteristics and operation.

5. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide manufacturer's recommended back box suitable for surface mounting where required.

6. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector to the base with a concealed socket headscrew to prevent unauthorized tampering.

7. Smoke detectors shall be UL 268 listed and FM approved.

8. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise and any Owner requests.
All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

9. Photo-obscuration type smoke detection shall be used for smoke detection unless indicated otherwise indicated.

C. Heat Detector:

1. The heat detector shall be a thermal sensor and shall constantly monitor the space temperature and constantly report this to the system. The unit shall be analog addressable.

2. The sensor shall use dual solid state thermistors and shall monitor the ambient temperature from 32 degrees F, to 155 degrees F and provide a fast response to rapid increase in temperature. The sensor shall send data to the FACP representing the analog value of the ambient temperature. The FACP shall be suitable to monitor for set temperature (selectable by detector for 135 or 155

degrees F) and rate of rise (selectable by detector for 15 or 20 degrees F per minute). Individual detector thermal settings shall be adjusted for the building/space characteristics and operation but shall initially be set to 135 degrees F set temperature and 15 degrees F per minute rate of rise. Shall only be provided to areas prone to physical damage.

3. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide back box suitable for surface mounting where required.

4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket headscrew to prevent unauthorized tampering.

5. Smoke detectors shall be UL 268 listed and FM approved.

6. All thermal sensors shall be field checked and set to meet the prevailing conditions of the premise. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

D. Addressable Initiation Module:

1. The addressable initiation module shall be used to connect supervised conventional initiating device or zone of supervised conventional initiating devices (water flow switches, tamper switches, manual pull stations, (4) wire smoke detectors, conventional (4) wire duct detectors, fire pump alarms, dry chemical fire extinguisher control panels, etc.) to one of the system's addressable circuits.

2. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device.

3. The module shall contain an integral LED that flashes each time the unit is polled.

E. Manual Pull Stations:

1. Non-coded pull-down type, double action (push then pull down) manual addressable units with front keyed test/reset. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Each unit shall have a distinct address. Units shall be key reset.

2. Units installed outdoors or in potentially wet locations shall be rated for such conditions.

3. Bright red finish with white lettering "FIRE ALARM".

4. Provide tamperproof clear lexan protective shield with speaker and batteries to produce 85 Db minimum sound pressure level at 10 ft. when shield is raised.

Shield shall have activation/deactivation switch with lockout screw, and 400 lb. breaking strength retaining cable.

5. Unless directly connected to a central station alarm service, municipal alarm system or local manned fire alarm dispatch station, a clearly legible sign shall be posted above each manual station stating: "LOCAL ALARM ONLY - NOT CONNECTED TO FIRE DEPARTMENT - CALL FIRE DEPARTMENT BY TELEPHONE".

F. Duct-Type Smoke Detector:

1. Detector shall be a photoelectric type that shall be activated by the presence of combustion products.

2. The detector head shall be a plug-in unit. The unit shall contain no moving parts. One chamber shall be for fire detection and the second chamber shall function as a reference, to stabilize the detector for changes in environmental temperature, humidity and pressure. It shall be possible to electrically check detectors sensitivity, using a sensitivity test set, or equivalent, and readjust the detectors sensitivity as required.

3. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket-head screw to prevent unauthorized tampering.

4. Smoke detectors shall be listed by Underwriter's Laboratories, Inc. and approved by Factory Mutual Insurance Company.

5. Provide complete with sampling tubes. Size sampling tubes for 80% of the width of the duct. Locate in ductwork for the indicated system and in accordance with the manufacturer's recommendations.

6. Provide auxiliary contacts and separate 24 VDC power to relay required for smoke damper operation.

7. Provide a remote indicating light/key test switch for each duct detector and mount in nearest corridor ceiling and labeled as to the damper is controlling.

8. Provide addressable base.

9. Duct detector shall report as a supervisory alarm at FACP.

10. Acceptable Manufacturer

a. Game Well / FCI M/N DNR with 151 remote test station.

G. Projected Beam Photo Electric Smoke Detectors:

1. Microprocessor based beam type smoke detector consisting of two units with projected light beam with measurement of smoke obscuration. Units shall have individual system addresses and a sensing range suitable for the intended location

with minimum capability up to 60 ft. x 330 ft. of detection area. Where an analog signal is not available provide an addressable initiation module for system interface.

2. System shall have an adjustable time delay (up to 30 seconds) for momentary beam blockage. Alarm sensitivity shall be adjustable.

3. System lensing shall be selected based on the intended location.

4. Shall initiate trouble alarm when dust obscures beam by 50%. Unit shall compensate for a gradual buildup of dust.

5. Installation with convenient beam alignment adjustments.

6. Provide with manufacturer surface mounting backbox for surface mounted locations.

7. Housing color to match the surrounding colors.

8. Operating voltage 18-32 VDC. Provide a 24 VDC power circuit from the FACP. Connect unit to the system addressable circuit with separate power connection.

9. Provide with remote indicator and testing station for each unit. Station shall indicate system condition (alarm, normal, trouble), have the ability to remotely test the system and have time delay/sensitivity adjustments. Mount station in local utility space and label for the specific unit.

10. Acceptable Manufacturer:

    a. Cornell University Standard UL listed for use with specified fire alarm control panel.

2.7 NOTIFICATION APPLIANCES

A. Speakers:

1. 24 volts DC.

2. Basic grille type with powder coated red finish paint.

3. Speakers shall be rated 94 dBA (anechoic chamer) at 10 feet. Output shall be selectable steady tone or coded. Provide dampening devices to reduce unit output by 5dBA for a minimum of 40% of the system speakers units and install as needed to meet the Owners needs.

4. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box.

5. Units installed outdoors or in potentially wet locations shall be rated for such conditions.

6. Provide directional projector where noted on the Drawings.

7. Provide backbox and grille for fully recessed installations; 4 in. deep box maximum.

B. Strobe Unit:

1. 24 volts DC with built-in Xenon Flasher; two watts maximum. Pulse duration shall be 0.2 seconds with maximum duty cycle of 40%. Illumination intensity shall be field selectable for 15, 30, 75 or 110 candela. Output setting shall be 15 candela in corridors, 75 candela in general areas, 110 candela in sleeping areas or as indicated. Flash rate minimum 1 Hz, maximum 2 Hz. Units within building shall flash in synchronization.

2. Protruding pyramid shaped lexan lens with reflector and the word "FIRE" imprinted on the lens.

3. Rated life shall be a minimum of 500 hours of continuous operation.

4. Units installed outdoors or in potentially wet locations shall be rated for such conditions.

5. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Wall or ceiling mounted as noted on the Drawings.

6. Provide surface backbox for surface installation; 4 in. deep maximum.

C. Combination Speaker-Strobe Units:

1. Unit shall be a combination of the speaker and strobe units specified above in a single manufactured unit.

D. Addressable Notification Appliances:

1. Notification appliances specified herein shall be addressable and individually programmed for use as dictated by the Owner. Notification shall be programmed by floor, office space, common space, specialty use space and others as directed. Appliances shall only annunciate upon the directed conditions and order.

2.8 ADDRESSABLE CONTROL MODULE

A. The addressable control module shall have an individual system address, be supervised and control an output dry contact from indication from the FACP. This can be used to control or have an input to elevator controls, notification appliances, door holder circuits, fans systems, etc. as indicated. Modules shall be connected to the addressable loop(s).

B. The unit shall control an output relay (dry contact form C). The module shall mount in a 4 in. square, 2-1/8 in. deep electrical box.

C. The module shall contain an integral LED that shall flash each time the module is polled.

D. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device. Each unit shall have a separate address and be connected to the system addressable signaling circuit.

2.9 REMOTE ANNUNCIATOR

A. Wall mount within a flush box. Maximum depth of 4 in., stainless steel trim. Nominal dimensions of 4" x 12".

B. Annunciation shall be by two line by 40 character LCD display to provide system information and alarm/trouble description.

C. Unit power and control shall be from the FACP. Unit circuiting shall be supervised.

D. Provide trouble signal with audible buzzer, silencing switch and system reset. All pushbuttons shall be inoperable without key switch activated. Pushbuttons for alarm acknowledge, silence and alarm reset shall be standard on the front with a description. Shall include a minimum of four auxiliary switches/pushbuttons to be programmed as coordinated with the owner (possible options are door holder release override, manual alarm initiation, elevator capture bypass, etc.).

E. Tamper-resistant front panel screws.

F. Provide a framed directory showing the building outline of each floor and referencing device descriptions. All lettering shall be minimum 1/2 in. high. Mount next to remote annunciator.

2.10 BATTERY AND CHARGER

A. Standby power shall be provided through 24 volt DC battery and automatic charger.

B. Provide sealed lead-calcium batteries, ampere-hour capacity which will allow system to operate 24 hours under supervisory condition and at the end of this period to operate all alarm signals for ten consecutive minutes.

C. Provide cell reversal protection.

D. Life expectancy shall be ten years minimum.

E. Charger shall be self-regulating, solid state, type, automatic with capability to fully charge the discharged battery within five hours.

F. Locate charger within the FACP enclosure. Locate batteries in a separate vented enclosure directly adjacent to the FACP.

2.11 PULL STATION ALARM COVER

A. Provide a protective alarm cover over manual pull stations where prone to physical damage. Unit shall allow easy access to the manual pull station and also provide an audible alarm when operated.

B. Unit shall provide a 95dB alarm at 1 foot and be powered from a 9VDC battery.

C. Unit shall be suitable for use in the intended location and pull station.

D. Acceptable manufacturer:

1. System manufacturer.

2. STI Stopper II

2.12 CENTRAL STATION

A. Required points are as follows, but not limited to, (water flow, manual pull, smoke detection, heat detection, special extinguishing systems, and supervisory signals). Provide all necessary programming.

B. Furnish and install a Digitize "Mux Pad" with one 3/4" conduit with pull line and communication cable to communications room and one 3/4" conduit with wiring per manufacturer requirements between FACP and Mux Pad.

PART 3 - EXECUTION

3.1 INSTALLATION, EQUIPMENT

A. All installations shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of Work.

Fire alarm installation shall be directed by a person who possesses a state license for installation of fire alarm systems. All equipment and components shall be installed in accordance with the manufacturer's recommendations.

B. System junction boxes and surface mounted device boxes shall be painted red.

C. Provide all wiring to sprinkler flow switches, pressure switches, and alarm check valves, installed by others. Maintain supervisory circuitry to the switches. Use liquidtight conduit for the last 2 ft. - 0 in. of raceway at the switch.

D. Provide all wiring to post indicator valves, OS&Y valves and dry pipe sprinkler system maintenance air pressure switches, provided by others. Wire into the supervisory alarm portion of the fire alarm system.

E. Provide all wiring to the smoke dampers installed by others. Provide an addressable control module for each. Wire to the damper junction box with flexible conduit and wire; provide box or boxes as required. Install according to NEC. Smoke dampers shall close when its associated smoke duct detector is in alarm, upon direction from the FACP or if the associated fan unit is not operating, including manual shutoff of power.

F. Provide all power supplies and wiring to smoke relief hatches and fire barriers provided by others. Smoke relief hatch or fire barrier shall operate only when its associated smoke detector is in alarm.

G. Provide all wiring to duct smoke detectors. Duct smoke detectors shall be mounted on the ventilating ductwork by others. All mounting arrangements, holes cut into ductwork, sealing of openings along with ceiling and access doors for the duct type detectors shall be provided by others. Provide duct detectors along with sampling tubes with end caps. Sequence smoke damper operation thirty seconds after its associated fan has been shut down. Duct detector shall report as supervisory alarm at FACP.

H. Provide all wiring required for fan shutdown. Wire from the addressable control module for each fan to be shut down and provide wiring from the module to the fan control unit (starter, adjustable speed drive, etc.)Dry contact shall be wired ahead of all control functions for starters. Provide intermediate relay for control circuits beyond the rating of the control module.

I. Provide all wiring for remote test station and status annunciation for a smoke damper.

J. Install all door holders in accordance with installation detail on the drawings and coordinate with the General Construction trade. Connect door holders to nearest 120 volt corridor receptacle circuit.

K. Provide all elevator capture control wiring. Installation shall be in accordance with manufacturer's recommendations.

L. Elevator machine room and shaft heat detectors shall be mounted within two feet of the sprinkler head where applicable.

M. Detection and initiating equipment shall be listed by NRTL and approved by FM.

N. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.

O. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.

P. Install wall mounted audio/visual signal devices at 80 in. AFF to bottom. Where ceiling types are called for, verify ceiling type and mounting height in the field. Provide pendant-mounted devices as required for specified mounting height.

Q. An auxiliary fire alarm relay used to control an emergency control device that provides control functions described in this specification shall be located within 3 ft. of the emergency control device and all wiring shall be supervised.

R. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise. All such Work shall be performed by an authorized representative of the manufacturer trained in such procedures.

S. Provide all wiring at the EP switch. Wire to the EP switch with flexible conduit and wire; provide box or boxes if required. Install according to NEC. Smoke dampers shall operate only when its associated duct smoke duct detector is in alarm.

T. Provide all power supplies and wiring to smoke relief hatched and fire barriers. Smoke relief hatch or fire barrier shall operate only when its associated smoke detector is in alarm.

U. All wiring shall conform to N.E.C. Articles 725 and 760, and to NFPA-72, "National Fire Alarm Code".

V. Label all fire alarm devices and system components (major equipment, conduit, junction boxes and cabling) according to the Cornell Standard 16710 and 283100.

3.2 SYSTEM CIRCUITING

A. Contractor shall attempt to reuse as much exiting wiring as possible throughout the facility. Only replace or provide new when necessary.

B. All wiring shall conform to the NEC, and to NFPA-72, National Fire Alarm Code.

C. Install all wiring in accordance with manufacturer's recommendations taking into account loading, intended location, circuit length, spare capacity and voltage drop.

D. All wiring shall be copper and installed in a dedicated/segregated red EMT conduit system.

E. Power circuits:

1. Provide the required quantity of 20 ampere, 120 volt circuits to the system with a minimum of one for the FACP.

F. Provide minimum #18 AWG twisted shielded pair for addressable signal line circuits. Notification appliance circuits shall be#14AWG minimum.

G. Addressable signal line circuits shall be NFPA 72 2010 Class A (redundant, single open operation).

H. Notification appliance circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).

I. Provide a 24VDC power circuit, #16 twisted pair minimum, with each initiation addressable circuit for the entire length.

J. Notification circuits shall be segregated as indicated on the drawings and by individual floors as a minimum. Circuits shall also be dedicated to audible or visual appliances but not both.

3.3 PROGRAMMING

A. Include in bid the cost to cover all system programming, including items particular to this project (such as custom zone descriptions, time delay settings, sensitivity settings, etc.) such that entire system is 100% complete and operating to the Owner's satisfaction. Coordinate all system programming with the Owner. Also, provide programming of the system a minimum of once during the warranty period to provide changes requested by the Owner.

3.4 SPARE EQUIPMENT

A. Provide the following spare equipment to the Owner. Deliver the equipment to the Owner designated location on the project site in original packaging.

B. Equipment to include:

1. Smoke detectors: 5% of each type used with a minimum of five.

2. Heat detectors: 5% of each type used with a minimum of five.

3. Addressable control modules: 2% of each type used with a minimum of two.

3.5 TESTING AND INSTRUCTION

A. The complete fire alarm system shall be fully tested after the installation is complete. Testing shall include all devices, FACP, annunciator panel, other panels, features and functions. Testing shall be witnessed by the owner’s representative, including the Cornell University Fire Marshall’s Office and authority having jurisdiction, and be in accordance with the NFPA and herein. Provide a testing report to the authority having jurisdiction and the Engineer as a submittal.

B. Provide a minimum of 2 hours of instruction to the operating personnel designated by the Owner's Representative with regard to use and operation of the system. Provide up to three programming modifications.

C. Provide three sets of keys to all panels, manual stations, etc., to the Owner's Representative.

D. Provide a copy of the system programming to the Owner on a CD/DVD disk or flash drive.

E. Provide to the Owner system Operation Manuals as specified, that shall include as a minimum.

1. Bill of Material.

2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.

3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.

4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting and control circuiting. Contact the Engineer for a copy of the project floor plans.

5. Typical Terminal Wiring Diagram for each type of device.

6. Terminal wiring Diagram for all Fire Alarm equipment.

7. Calculations including:

   a. Battery sizing calculations indicating total number of power devices, load associated with each type device and recommended battery capacity (AH).

   b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.

8. Instruction report starting when instruction was given and who was in attendance, signed by Owner's Representative.

9. A written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved.

10. Certificate of Completion as described in NFPA-72.

11. A two year warranty in accordance with the Basic Requirements of these Specifications shall be provided for this system.

12. All devices shall be pre-tested by the contractor and distributor prior to scheduling final acceptance test with AHJ and EH&S.

13. Final test to be done with AHJ and EH&S present.

3.6 FIRE / SMOKE DAMPER OPERATION

A. Installed Smoke Detection Devices and Smoke Dampers

1. Smoke dampers are installed at each duct/smoke barrier penetration.

2. Every smoke damper has a local duct smoke detector.

3. Every smoke damper has a local remote test station and status annunciation.

4. Every duct smoke detector is addressable and is connected to the building fire alarm system.

5. The building project area is provided with addressable area smoke detectors.

B. Fire Alarm Activation of Smoke Dampers

1. Duct Smoke Detectors:

a. Upon activation of any duct smoke detector, an addressable signal is sent to the building fire alarm system and the smoke damper associated with duct smoke detector is closed.

b. Upon receipt of the addressable duct smoke detector signal, the building fire alarm system shuts down both the supply and return fans or the exhaust fan, associated with the duct system that experienced the detector activation.

c. Upon receipt of the associated fan system drives being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

C. Non-Fire Alarm System Activation of Smoke Dampers (These activations do not cause for a building fire condition to be annunciated)

1. Safety Device Activation

a. Upon activation of either the low-limit switch (freeze-stat) or the supply duct high static pressure switch, both the supply and return fans are de-energized via hardwiring of the low limit switch in the fan starter circuits.

b. The building fire alarm system point addressable module that is installed at the variable frequency drive of the supply and return fans then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated fan system drives being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

2. BMS (Building Management System) Component Fault

a. Upon activation of any of the following BMS component faults, the supply and return fans, or exhaust fan are de-energized via BMS.

1) Supply fan VFD fault

2) Return fan VFD fault

3) Exhaust fan VFD fault

4) Exhaust fan current sensor fault

5) Outside air damper end switch fault

6) Return air damper end switch fault

7) Exhaust air damper end switch fault

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

3. EMCS Operator Activation:

a. When the EMCS system operator overrides the operational status of the air handling system and shuts down the supply, return, or exhaust fans.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

4. Maintenance Operator Activation:

a. When a building maintenance staff member manually shuts off the supply, return or exhaust fan at the starter disconnect switch, the supply, return or exhaust fans are shutdown.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

D. Smoke Damper Testing - M/E Engineering offers the following suggestions for a smoke damper testing protocol. The actual final protocol needs to be authored and approved by all Cornell parties and agencies of interest.

1. Duct Smoke Detector (Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager and Cornell Fire and Safety, apply smoke to any duct smoke detector in the ductwork of any air handling systems which serve the project area.

b. Upon receipt of the addressable duct smoke detector signal, the building fire alarm system shuts down both the supply and return, or exhaust fans associated with the duct system that experienced the detector activation.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

2. Safety Device Activation (Non-Fire Alarm Condition)

a. Under controlled conditions and with proper notification to the Building Manager, manually trip the low limit switch (freeze-stat) associated with any air handling system in the project area.

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

d. Confirm damper closure at the local smoke damper access door.

3. BMS Component Interlock or Fault:

a. Under controlled conditions and with proper notification to the Building Manager, manually cause for a fault condition to occur in any of the following BMS components:

1) Supply fan VFD fault

2) Return fan VFD fault

3) Exhaust fan VFD fault

4) Exhaust fan current sensor fault

5) Outside air damper end switch fault

6) Return air damper end switch fault

7) Exhaust air damper end switch fault

b. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

c. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

d. Confirm damper closure at the local smoke damper access door

4. EMCS Operator Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually override the operational status of any air handling system via laptop, PC or remote access to EMCS Webcontrol and shutdown the associated air handing system.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

5. Maintenance Operator Activation (Non-Fire Alarm Condition):

a. Under controlled conditions and with proper notification to the Building Manager, manually shut off any air handling system within the project area.

b. The shutdown of the supply, return or exhaust fans shall be interlocked through DDC programming. If the supply fan is shutdown, the return fan shall also be shut down automatically. If the return fan is shutdown, the supply fan shall be shut down automatically.

c. The building fire alarm system point addressable module that is installed at the variable frequency drive, or motor starter current sensor, of both the supply and return fans or exhaust fan, then sends an addressable signal to the building fire alarm system indicating that the air handling system has been shut down.

d. Upon receipt of the associated supply, return or exhaust fan system drive/starter being shut down, the building fire alarm system shall close all smoke dampers associated with that duct system on a 30 second delay.

e. Confirm damper closure at the local smoke damper access door.

END OF SECTION

APPENDIX A
FIRE ALARM SYSTEM OPERATION/SEQUENCE MATRIX

System Outputs

System Inputs	**Actuate Common Alarm Signal Indictor**	**Actuate Audible Alarm Signal**	**Actuate Common Supervisory Signal Indicator**	**Activate Audible Supervisory Signal**	**Actuate Common Trouble Signal Indicator**	**Activate Audible Trouble Signal**	**Indicate Zone or Device Description**	**Activate Notification Appliances**	**Display Change of Status on All Annunciators/Printers**	**Transmit Alarm Signal to Central Station**	**Transmit Supervisory Signal to Central Station**	**Transmit Trouble Signal to Central Station**	**Release Magnetically Held Doors**	**Recall Elevator to Recall Floor**	**Actuate Warning to Elevator Controls**	**Actuate Warning to Elevator Cabs**	**Activate Elevators Shunt Trip**	**Close All Related Smoke Dampers**	**Unlock All Exits and Control Doors**	**Shutdown Respective Air Handling Units (SA and RA)**	**Activate Floor Pressurization (High Rise Only)**	**Activate Stairwell Pressurization (High Rise Only)**	**Active Smoke Exhaust (High Rise Only)**	**Open Associated Smoke Hatch**	**Local Notification**
Fire Alarm System AC Power Failure					X	X						X													
Fire Alarm System Low Battery					X	X						X													
Open Circuit					X	X						X													
Ground Fault					X	X						X													
Circuit Short					X	X						X													
Manual Pull Station Actuation	X	X					X	X	X	X			X						X						
Area Smoke Detectors	X	X					X	X	X	X			X	X				X	X		X	X	X		
HVAC Air Duct Smoke Detector			X	X			X		X											X					
Area Heat Detectors	X	X					X	X	X	X			X	X				X	X		X	X	X		
Fire Suppression System Alarm	X	X					X	X	X	X			X	X				X	X						
Sprinkler Tamper Switch			X	X			X				X														
Fire Suppression System Alarm	X	X					X	X	X	X			X	X				X	X						
Sprinkler Tamper Switch			X	X			X				X														
Sprinkler Water Flow in Building	X	X					X			X			X	X				X	X						
Sprinkler Water Flow in Elevator Equipment Room or Shaft	X	X					X	X	X	X					X	X	X	X							
Elevator Shaft Smoke Detector	X	X					X	X	X	X														X	
Elevator Equipment Room Area Smoke Detector	X	X					X	X	X	X			X	X		X		X	X						
Elevator Shaft and Equipment Room Heat Detectors	X	X	X	X			X	X	X	X			X	X		X	X	X	X						
Elevator Pit Sprinkler Flow	X	X					X			X				X	X	X	X								
Elevator Pit Heat Detector	X	X					X	X		X				X	X	X	X								
Elevator Lobby Smoke Detectors	X	X					X	X	X	X			X	X				X	X		X	X	X		
Elevator Lobby Recall Floor	X	X					X	X	X	X			X	X				X	X		X	X	X		
Fire Pump Power Failure/Phase Reversal			X	X			X		X	X	X	X													
Fire Pump Low Fuel			X	X			X		X	X	X		X	X				X	X						
Fire Pump Running	X	X					X		X	X			X	X				X	X						
Jockey Pump Running			X	X			X		X		X														
Fire Pump not in Automatic Mode	X	X					X			X															
Area of Refuge Two-Way Communication Status	X	X					X			X															
Smoke Detector Adjacent to Smoke Hatch	X	X					X	X	X	X			X	X					X						
AHU Off, Any Reason																		X							
CO Detection			X	X			X		X		X														X

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Suitable soil material for fill, backfill and embankment construction.
2. Structural Fill for various locations of backfill and embankment construction.
3. Controlled low strength material.
4. Bioretention Soil for placement at dry swale construction.

B. Related Sections:
1. Division 31 Section 310516 “Aggregates for Earthwork” for various stone and sand aggregates used as part of this project.
2. Division 31 Section 312000 “Earth Moving” for excavation, backfill, placement and compaction of various soil types.
3. Division 31 Section 312319 “Dewatering” for construction dewatering.
4. Division 31 Section 315000” Excavation Support and Protection” for temporary excavation support and protection systems.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Fill: Soil materials used to raise existing grades.

C. Structural Fill: Material as defined in Section 310516, Type A11 Aggregate. On site soil materials meeting this requirement can be substituted for this use. On site material will be considered by the Owner’s Representative for substitution if the Contractor can demonstrate that on site material can be modified to meet the requirements of this material.

D. Select Granular Fill: Material as defined in Section 310516, Type A2 Aggregate. On site soil materials meeting this requirement can be substituted for this use. On site material will be considered by the Owner’s Representative for substitution if the Contractor can demonstrate that on site material can be modified to meet the requirements of this material.

E. Controlled Low Strength Material (Flowable Fill): A flowable, self-compacting, low density cementitious material which shall gain sufficient strength to be walked on and buried within a day, and which shall remain excavatable by hand tools after curing.

F. Bioretention Soil: Soil for use in dry swales that consists of a uniform mix of sand and topsoil, free of stones, stumps, roots (or other objects larger than 2” in diameter), and free of noxious weeds.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
1. Soil Materials (if imported from off-site).

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D 1557.

1.4 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Suitable Material (Subsoil Type S-1) – Suitable Material is defined as soil material whose composition is satisfactory for embankment construction. The moisture content of the material has no bearing upon this designation. In general, any mineral (inorganic) soil, blasted or broken rock and similar materials of natural or man made (i.e. recycled) origin, including mixtures thereof,

are considered suitable materials. Determination of whether a specific natural or man made material is a suitable material shall be made by the Owner's Representative on the above basis.

Furthermore, Suitable Material shall be soil that falls within Classification Groups GW, GP, GM, SW, SP, SM according to ASTM D2487 "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)", or a combination of these groups.

1. Material shall be free of rock or gravel larger than 3-inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
2. Soil classified as GM, SP or SM can be used; however, these soil types can be moisture sensitive and difficult to work with. No additional expense shall be incurred by the Owner if the Contractor chooses to use these materials and the required compaction cannot be achieved.

C. Unsuitable Material – Unsuitable Material is defined as any material containing vegetable or organic matter, such as muck, peat, organic silt, topsoil, or sod, that is not satisfactory for embankment construction. Certain man made deposits of industrial waste, toxic or contaminated materials, sludge, landfill, or other materials may also be determined to be unsuitable, based on an evaluation by the Owner's Representative.

1. Soils that are Unsuitable Material are further defined as soil within the Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)", or a combination of these groups.
2. Broken pieces or sections of asphalt pavement, macadam, or similar construction debris material that contains petroleum based products are also considered unsuitable for this Project.
3. The moisture content of a soil has no bearing upon the designation of a soil material as being an unsuitable or suitable soil. (Refer to Section 312000, Earthmoving).

D. Controlled Low Strength Material (CLSM) – Controlled Low Strength Material (flowable fill) shall have a compressive strength between 40 psi and 150 psi. Contractor to certify that the Controlled Low Strength Material meets the following requirements:

1. Portland Cement, Type 1 or Type 2: Shall comply with ASTM C150. Pozzolans and other cementitious materials shall comply with ASTM C618. Note that if CLSM is to be placed around ductile iron pipes, it shall not contain fly ash. If not placed near metals, Class "C" or Class "F" Fly Ash can be used.
2. Water: Use water, which is potable and free from deleterious amounts of alkali, acid, and organic materials, which would adversely affect the setting time or strength of the CLSM.
3. Aggregates: 100% passing the No. 10 sieve and a maximum of 20% passing the No. 200 sieve.
4. Do not place CLSM in temperatures less than 40° F, nor when freezing temperatures are expected with 24 hours. If these conditions cannot be met, consult with the manufacturer and determine procedures and protection necessary to ensure proper CLSM installation and curing.

E. Bioretention Soil – Defined as uniform mix of three (3) parts sand and one (1) part topsoil, by volume. This soil shall be free of stones, stumps, roots (or other objects larger than 2" in diameter), and free of noxious weeds. The Bioretention soil shall have a pH range of 5.2 to 7.6, and an organic content of 6% to 7%. In order to meet the requirement of 6% to 7% organic content in the bio soils, the Contractor may add suitable compost material to achieve this requirement for organic content. Compost that is used shall meet the requirements of NYSDOT 2013 Standard Specifications Section 713-15.

1. Topsoil shall be onsite material when possible amended to meet the following general requirements:
2. pH range between 5.5 and 7.6
3. Organic Content not less than 6% or more than 12% (dry weight basis)
4. Percent of topsoil (by weight) that passes through a No. 200 (75-µm) US standard sieve is 20% to 65%.
5. Additional topsoil requirements are included in Specification Section 329113.
6. Requirements for Sand:
7. Meeting the requirements of Sand, A9 Aggregate, as defined in Section 310516.
8. Soil Amendments to increase organic content shall be peat moss. Peat moss shall be commercially produced, composed of the partly decomposed stems and leaves of any or several species of sphagnum moss.
9. The Contractor shall provide the Owner's Representative with a copy of the soil test results that show the overall gradation, organic content, and concentration of soil phosphorus. (Concentration of soil phosphorus will not be a basis for acceptance or rejection of the bioretention soil, but is required for the Owner's records).

F. Topsoil – Refer to Section 329113 for additional requirements. Topsoil may be naturally occurring or may be manufactured.

G. If naturally occurring topsoil exists on the site it shall be the surface layer of soil removed during soil stripping operations.

H. All topsoil shall be free from refuse, material toxic or otherwise deleterious to plant growth, subsoil, sod clumps, seeds or other viable propagules of invasive plants, woody vegetation and stumps, roots, brush, refuse, stones, clay lumps, or similar objects.

I. Construction and demolition debris as classified under 6 NYCRR Part 360, other than uncontaminated land clearing debris, shall not be used to manufacture or amend topsoil. Sod and herbaceous growth such as grass and non-invasive weeds need not be removed but shall be thoroughly broken up and mixed with the soil during handling or manufacturing operations.

J. Existing topsoil stripped and stockpiled shall be tested and amended by the Contractor as needed to meet the requirements of Specification Section 329113.

PART 3 - EXECUTION

3.1 **STORAGE OF SOIL MATERIALS**

A. Refer to Section 312000 (Earthmoving).

3.2 Placement of Soil Materials in Embankment Construction

A. Refer to Section 312000 (Earthmoving) for Embankment Construction.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Protecting existing vegetation to remain.
   2. Removing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and abandoning site utilities in place and removing site utilities.

B. Related work as specified elsewhere:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
   2. Division 31 Section “Erosion and Sedimentation Controls” for erosion control.
   3. Division 31 Section "Earth Moving" for soil materials, excavating, pneumatic trenching, backfilling, and site grading.
   4. Division 32 Section “Landscape Soils Preparation” for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.03 DEFINITIONS

A. Topsoil: Natural or cultivated surface soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.04 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

E. Except for materials indicated to be stockpiled, reinstalled or to remain Owner’s property, cleared materials shall become Contractor’s property and shall be removed from the site.

1.05 SUBMITTALS

A. Record Drawings
   1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be experienced in providing and installing equipment of the kind indicated and shall have a record of successful in-service performance.

B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Project Meetings.”

PART 2-PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section “Excavation and Backfilling.”
   1. Obtain approved borrow soil materials off site when satisfactory soil materials are not available on site.

2.02 CONSTRUCTION FENCING

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

PART 3-EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE PROTECTION

A. Do not store construction materials, debris, or excavated material within drip line of remaining trees.

B. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

C. Do not excavate within drip line of trees, unless otherwise indicated.

D. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

E. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Landscape Architect.
   1. Employ a qualified arborist, licensed in jurisdiction where project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full growth status.

. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than four days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

G. Excavate for and remove underground utilities indicated to be removed.

3.04 UTILITIES

A. Owner's Representative will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner's Representative will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than four days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

G. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within tree protection zones.
   3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.08 DISPOSAL

B. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.
   1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
1. Laying out and staking all lines and levels.
2. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
3. Excavating and backfilling for footings, foundations, and below-grade construction.
4. Granular drainage backfills for columns and trenches.
5. Dewatering
6. Pneumatic excavation (air spade) within drip line of trees to remain.
7. Separation fabric.
8. Light stone fill.

C. Related work as specified elsewhere:
1. Division 31 Section "Site Clearing and Demolition" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, temporary tree protection, and removal of above- and below-grade improvements and utilities.
2. Division 32 Section "Landscape Soils Preparation" for finish grading, including preparing and placing topsoil and planting soil for lawns.
3. Division 32 Section “Turf & Grasses” for lawn establishment.

1.03 DEFINITIONS

A. Granular Backfill: Soil materials used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Layer placed over excavated subgrade in a trench before laying a pipe.

C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations.
1. Additional Excavation: Excavation below subgrade elevations as directed by Landscape Architect. Additional excavation and replacement will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Landscape Architect. Unauthorized excavation, as well as remedial work directed by Landscape Architect, shall be without additional compensation.

F. Fill: Soils materials used to raise existing grades.

G. Rock: Rock materials in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. (0.76 cu. m) for bulk excavation or ¾ cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch (1065 mm) wide, short-tip-radius rock bucket; rated at not less than 120-hp (89 kW) flywheel power with bucket-curling force of not less than 25,000 lbf (111 kN) and stick-crowd force of not less than 18,700 lbf (83 kN); measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210 hp (157 kW) flywheel power and developing a minimum of 45,000 lbf (200 kN) breakout force; measured according to SAE J-732.

H. Structures: Building, footings, foundations, retaining walls, slabs, or other man-made stationary features constructed above or below the ground surface.

I. Subbase course: Course placed between the subgrade and a cement concrete or hot mix asphalt pavement.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

K. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities servicing facilities occupied by Director or others unless permitted in writing by Owner’s Representative and then only after arranging to provide temporary utility services according to requirements indicated.

1. Do not proceed with utility interruptions without Owner's Representative's written permission.
2. Contact Dig Safely New York at 1-800-962-7962 before starting site clearing or excavation operations.
3. Coordinate with Owner's Representative and utility companies to shut off services if lines are active.
4. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner's Representative and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility owner.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Subbase (with sieve analysis)
   2. Select Fill (with sieve analysis)
   3. Separation fabric.
   4. Material submittals shall include NYSDOT approved source numbers, gradations, proctors and soundness test results. Testing to be done within 3 months of the submittal date.

B. Samples:
   1. 12-by-12 inch (300-by-300 mm) sample of separation fabric.
   2. 12-by-12 inch (300-by-300 mm) sample of filter fabric.
   3. 5 lb (2.2 kg) of stone mulch in labeled plastic bags.

1.06 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

PART 2-PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available for excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM or a combination of these groups symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen material, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. On Site Material: All on-site material to be used as fill shall be soil or soil-rock mixture which is free from organic matter and other deleterious substances. It shall contain no rocks or lumps over 4 inches in greatest dimension.

E. Imported Fill Material: Imported fill material shall consist of clean, well-graded sand and/or gravel containing less than 15 percent by weight of materials passing a No. 200 sieve and a maximum particle size of 4 inches.

F. Backfill and Fill: Satisfactory soil materials.

G. Drainage Stone: Clean, sound, durable, sharp-angled fragments of rock of uniform quality and conforming to NYSDOT Material Designation 703-0201, Size Designation No. 2.

H. Light Stone Fill: Clean, sound, durable, sharp-angled fragments of rock of uniform quality and conforming to NYSDOT Material Designation 733-2101, Stone Filling, Fine and Table 733-21A for size designation.

I. Select Fill: NYSDOT Specification 733-11 Select Structure Fill.

J. Subbase: NYSDOT Type 2, naturally or artificially graded crushed ledgerock which is sound, durable, and free of organic and other deleterious materials conforming to NYSDOT Item 304.12. Material to have 20 percent or less loss after 4 cycles of NYSDOT Magnesium Sulfate Soundness Test.

K. Structural Soil: A mixture of crushed stone, clay loam, hydrogel and amendments meeting the requirements of "CU Structural Soil®" patented by Cornell University (Patent #5,849,069) also known as "CU SoilTM". Material shall meet the requirements of NYSDOT Item 610.14000011 Structural Soil Mix.
   1. The material shall be obtained from a Producer sublicensed by Amereq, the exclusive Licensee of Cornell University for CU-Structural Soil®. Proof of such sub-licensing shall be submitted to the Engineer along with a sample of the finished mix, prior to delivery to the site. For a list of licensed CU Soil™ producers, call AMEREQ, Inc. @ 1-800-832-8788.

2.02 ACCESSORIES

A. Separation Fabric: The geotextile fabric for pavement stabilization shall be Mirafi 500X as manufactured by Mirafi, AMOCO 2002, Synthetic Industries 200ST or approved equal. The geotextile fabric shall be woven fabric of only continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew, and rot resistant. The fabric shall be UV stabilized with the following properties:

		Acceptable Value	Test Method
1.	Grab Tensile Strength, kN (lbs)	0.9 (200)	ASTM D4632
2.	Elongation at Failure, % MD/ CD	15/ 10	ASTM D4632

3.	Mullen Burst Strength, kPa (psi)	2756 (400)	ASTM D3786	
4.	Trapezoidal Tear Strength, kN (lbs)	0.33 (75)	ASTM D4533	
5.	Puncture Strength, kN (lbs)	0.40 (90)	ASTM D4833	
6.	Apparent Opening Size (AOS)	50 US Std. Sieve	0.30 mm	ASTM D4751
7.	Permittivity, sec-1	0.05	ASTM D4491	
8.	Flow Rate, l/min/m2 (gal/min/sf)	200 (5.0)	ASTM D4491	
9.	UV Resistance after 500 hrs, % strength	70	ASTM D4355	

B. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from plyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759. Fabric shall be listed on the NYSDOT approved list for Drainage Geotextile.

C. Geotextile drainage fabric shall conform to the following minimum property values:
1. Grab Tensile Strength: 157 lbf ; ASTM D 4632-86.
2. Trapezoidal Tear Strength: 56 lbf; ASTM D 4533-85.
3. Puncture Resistance: 309 lbf; ASTM D 6241 (2" Probe).
4. Water Flow Rate: 75 gpm per sq. ft. ASTM D 4491-85.
5. Apparent Opening Size: No. 70; ASTM D 4751.

2.03 PNEUMATIC EXCAVATION (AIR SPADE)

A. Pneumatic Excavating Tool: Excavation within drip line of trees to remain shall be performed through the use of a pneumatic excavation tool with the following requirements.
1. The high air velocity excavation tool shall be specifically designed to fracture, pulverize, and displace porous and semi-porous soils without harming or causing damage to tree roots, existing subsurface utilities or other non-porous objects. The Contractor shall submit catalog cuts from the manufacturer verifying that the pneumatic excavation tool meets the following criteria:
   a. Rated Operating Pressure 6.2 - 7.0 bar.
   b. Air Stream Velocity at Cutting Head 2,200-2,500 km/hr
   c. Air Displacement 4,000-5,000 L/min

B. Air Compressor: The air compressor may be either a portable or truck-mounted unit and shall be adequately sized as required to power the pneumatic excavation tool in accordance with the manufacturer's recommendations for the pneumatic excavating tool.

C. Vacuum Truck: A vacuum truck should be used to collect excavated spoil directly from the trench or pit.

D. Containment Structure: To prevent the spread of excavated soil onto adjacent roadways and areas beyond the designated work zone limits, the Contractor shall provide a mobile structure or barrier to contain the material dislodged by the pneumatic excavation tool from the trench or pit. Timber or corrugated metal shields, tents supported on tubular frames, or other structures as approved by Landscape Architect may be used.

PART 3-EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where earthwork is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge or soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water from excavations. Maintain water levels below base of excavation to control hydrostatic pressure on subgrade soils.
2. Establish and maintain temporary drainage ditches and other diversion outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

3. Do not discharge sediment laden water into the adjoining storm or sanitary sewer system or open swales. Pump sediment laden water from excavations into a portable sediment tank or a high-strength, non-woven geotextile fabric bag. Size portable sediment tanks in accordance with the New York Guidelines for Urban Erosion and Sediment Control.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system as needed to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.04 EXPLOSIVES

A. Explosives: Do not use explosives.

3.05 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition.
1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

D. Material Storage: Stockpile satisfactory excavated materials where directed until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
2. Dispose of excess soil material and waste materials not re-used.

3.06 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
1. Clearance: As indicated in drawings.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Excavate surfaces under walks and pavements to indicated cross section, elevations, and grades.

3.07 APPROVAL OF SUBGRADE

A. When excavation has reached required subgrade elevations, notify Geotechnical Engineer who will make an inspection of conditions.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Proof-rolling is to be done in the presence of the project Geotechnical Engineer after excavation to required subgrade elevations. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

2. Proof-roll with a (13.6 tonnes)self-propelled roller in non-vibratory mode weighing at least 14,000 lbs.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted structural fill as directed by the Geotechnical Engineer.

D. Additional Excavation:
1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Geotechnical Engineer. Excavation of unsuitable material must extend laterally beyond the edge of the footing or slab for a distance equal to or greater than the required depth of the excavation.
2. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.
3. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect.

3.08 UNAUTHORIZED EXCAVATION

A. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimension without specific direction of Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by Geotechnical Engineer, shall be at Contractor's expense.

B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Geotechnical Engineer.
1. Fill unauthorized excavation under other construction or utility pipe as directed by Geotechnical Engineer.

3.09 STORAGE OF SOIL MATERIALS

A. Stock pile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Surveying locations of underground utilities for record documents.
2. Inspecting and testing underground utilities.
3. Removing concrete formwork.
4. Removing trash and debris.
5. Removing temporary shoring, bracing, and sheeting.
6. Installing permanent or temporary horizontal bracing or horizontally supported walls.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of **s**atisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.
1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the utility pipe or conduit.

F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

I. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
1. Under grass and planted areas, use satisfactory soil material.

2. Under base course for walks and pavements, use satisfactory soil material.
3. Under footings and foundations, use Granular fill.

3.13 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 9 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 92 percent.
   3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.

D. Compact each lift of crushed stone with at least four passes of vibratory compaction device.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
   2. Pavements: Plus or minus 1/4 inch (13 mm).

3.16 SUBBASE COURSES

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place subbase course material over subgrade under concrete pavement.
   3. Shape subbase course to required crown elevations and cross-slope grades.
   4. Place subbase course 6 inches (150 mm) or less in compacted thickness in a single layer.
   5. Place subbase course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   6. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 6 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Geotechnical Engineer.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed as the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 200 sq. ft. (186 sq. m) or less of paved area, but in no case fewer than three tests.

2. Foundation Backfill: At each compacted backfill layer, at least 1 test for each 100 feet (30 m) or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet (46 m) or less of trench length, but no fewer than 2 tests.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly grades areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and re-compact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplemental conditions and Division 31 specifications apply to this section.

1.2 SUMMARY

A. This section includes work that complements work in the following sections:
   1. Site Preparation, Section 31 10 00;
   2. Earthmoving, Section 31 20 00;
   3. Trenching and Backfilling, Section 31 23 33; and
   4. Excavation Support and Protection, Section 31 50 00.

B. This section specifies dewatering that consists of performing all work necessary to remove snow, ice, surface water, and/or control other water infiltration in order that all excavation and construction is performed in the dry. The Contractor shall maintain and operate adequate surface and subsurface drainage methods to the satisfaction of the Owner's Representative in order to keep the construction site dry and excavation side slopes and bottom stable such that all construction can proceed unhindered by saturation and degradation of the area in accordance with the plans and specifications and to the satisfaction of the Owner's Representative.

C. Dewatering work shall include all design installation, operation, maintenance, supervision, dismantling and removal from the site, including proper site restoration of dewatering systems required to perform the work as shown and specified herein.

D. The required dewatering system should be designed by a Professional Engineer licensed to practice engineering in New York State.

1.3 GENERAL

A. The Contractor must become familiar with the potential for precipitation, the site conditions, and the subsurface conditions.

B. The Contractor shall have on site such equipment as pumps, hoses, etc., as necessary to deal with dewatering. Dewatering system(s) shall be properly designed and constructed to prevent removal of soil fines from the site during dewatering operation. The Contractor shall monitor the dewatering system and should loss of fines be noted water removal shall cease immediately and the Owner's Representative notified. The Contractor shall modify the water removal methods as necessary to eliminate further loss of ground, and shall repair any such loss of ground to the satisfaction of the Owner's Representative.

C. If ponded water, from any source, surface or subsurface, accumulates or collects on prepared subgrades, in excavations, or on fill surfaces, the subgrade surfaces shall be excavated and replaced as directed by the Owner's Representative, at no additional cost to the Owner.

1.4 SUBMITTALS

A. General: Submittals shall be made according to the conditions of the Contract and Division 1 Specifications Sections.

B. Submit and review proposed dewatering methods with the Owner's Representative prior to commencing dewatering operations.

C. Submit proposed procedures and material specifications for all erosion control materials prior to commencing field activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw bales, as required by the Owner's Representative.

B. Silt fencing and associated materials shall be as shown on the Contract Drawings. Filter cloth shall be Filter X, Mirafi 100X, Stabilika T140N or approved equal.

C. Earth materials shall be as specified in Earthmoving, Section 31 20 00.

D. Temporary Seeding shall as specified in Seeding, Section 32 92 13.

E. Dust Control shall consist of vegetative covers, sprinkling (water), barrier material (silt fence), mulch, and acrylic polymer, latex emulsion, or resin in water spray adhesives. All dust control shall be in accordance with 31 20 00 Earthmoving.

PART 3 - EXECUTION

2.2 SURFACE DRAINAGE

A. Maintain and operate adequate surface drainage methods to keep the construction site dry and excavation side slopes and bottom stable such that all construction, as required, can proceed unhindered by saturation and degradation of the area.

B. Surface water shall be controlled so that the stability of excavations and constructed slopes or bottoms are not adversely affected by water, erosion is prevented, and flooding of excavations does not occur.

C. Surface water must be intercepted and drained away from excavations to protect proposed bearing surfaces.

D. Surface water shall not pond on subgrades, in excavations, or on fill.

E. The design and installation of all surface water control features shall be as shown on the Contract Drawings and conform to the Stormwater Pollution Prevention Plan (SWPPP) and Erosion and Sediment Control Plan, unless otherwise directed by the Owner's Representative.

2.3 SUBSURFACE DRAINAGE

A. Prevent groundwater from flowing into excavations and trenches and from flooding prepared subgrades and excavations.

B. Do not allow water to accumulate in excavations or trenches. Remove water from all excavations immediately to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Furnish and maintain pumps, sumps, suction and discharge piping systems, and other system components necessary to convey the water away from the Site.

C. All pumps and water removal methods shall be designed, installed, and operated in a manner that does not result in loss of ground or removal of fines during operation. Should loss of fines be noted, water removal shall cease immediately and the Owner's Representative notified. The Contractor shall modify the water removal methods as necessary to eliminate further loss of ground, and shall repair any such loss of ground to the satisfaction of the Owner's Representative.

2.4 DISPOSAL OF SURFACE WATER and GROUNDWATER

A. Develop plans to properly collect and discharge surface water and groundwater.

B. Dispose of all water removed from the excavation and site in a manner that will not endanger public health, property or portions of the work under construction or completed. Dispose of water properly and in a manner that will not inconvenience others engaged in work at the site and/or adjacent property owners. Dispose of water in conformance with the SWPPP, and Erosion and Sediment Control Plans.

C. All water removed from excavations shall be conveyed in closed conduits or pipes, to appropriate discharge locations. Trenches or other excavations shall not be used for temporary drainage ditches for removal of accumulated surface water.

D. Provide and maintain appropriate erosion and sediment controls in accordance with the SWPPP, and Erosion and Sediment Control Plans, and as directed by the Owner's Representative.

2.5 RESTORATION

A. Remove and restore all temporary drainage devices, ditches, sumps, catch basins and drainage piping when no longer needed. All restoration shall be completed to the satisfaction of the Owner's Representative and all costs shall be included as part of the base bid.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplemental conditions and Division 31 specifications apply to this section.

1.2 SUMMARY

A. This section includes work that complements work in the following sections:
   1. Site Clearing, Section 31 10 00;
   2. Earthmoving, Section 31 20 00;
   3. Dewatering, Section 31 23 19; and
   4. Excavation Support and Protection, Section 31 50 00.

B. This section pertains to excavating and backfilling of underground utilities. The Contractor shall verify the location of all existing utilities prior to excavating for new work by contacting the U.F.P.O. and by coordinating with the Owner's Representative.

C. The Contractor shall excavate, protect and backfill all trenches that may be necessary for completing the work to be done under this contract as specified herein and on the Contract Drawings. All excavations shall be in open trenches, except where and to such extent as the Owner may authorize or require that the same be done by tunneling, boring or jacking. Trenches may be in general excavated or backfilled either by machinery or by hand as the Contractor may elect; provided, however, that the Owner shall be empowered, wherever he/she shall decide that such necessity exists, to require that hand excavation be employed and that backfilling by hand shall be done to the extent required at no additional cost to the Owner.

D. The Contractor shall perform all excavation of every description and of whatever substance encountered, to the depths indicated on the Contract Drawings, as specified herein, or as required by the Owner. All excavated material not required for backfill shall be removed and wasted or otherwise disposed of as required or specified.

E. Excavation support methods as specified in Section 31 50 00, shall be designed by a Professional Engineer licensed to practice engineering in New York State.

1.3 DEFINITIONS

A. Excavation shall be classified as follows:
   1. Earth Trench Excavation- The removal to required elevations of all clay, silt, loam, sand, gravel hardpan, pavements of all kinds, loose stone and all boulders measuring less than one (1) cubic yard in volume.
   2. Rock Trench Excavation- The removal of ledge rock, mass concrete structures and boulders measuring more than one (1) cubic yard in volume.

B. Excavation
   1. All procedures and requirements of Section 31 20 00 Earthmoving shall be applicable for trench excavation and protection of bearing surfaces.
   2. Underpin or otherwise support in a suitable manner, adjacent structures which may be damaged by excavating work, including utilities and pipe chases.
   3. Excavate to accommodate new structures and construction operations.
   4. Notify Owner's Representative or Owner of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
   5. Work shall be scheduled so the deepest elements are completed first when undermining of shallower elements could occur.
   6. Excavation cuts shall be sloped sufficiently to prevent material from sliding into the excavation and to comply with local, state, and Federal codes and regulations. Sheeting and bracing shall be placed as conditions warrant per OSHA Standards.
   7. Materials shall not be placed adjacent to the sides of open excavations within a distance equal to two times the maximum depth of the excavation. Stockpiling material over the existing utilities, structures, sewers, force mains or water lines shall not be permitted
   8. Excavation shall not continue in trenches where standing water is observed in the work area.
   9. Cut utility trenches wide enough to allow inspection of installed utilities.
   10. The bottom of excavations shall be protected from frost action and surface drainage. Frozen material shall be removed and replaced with granular fill or concrete.
   11. All rock surfaces shall be level and cleaned of loose material. Depressions or cracks in rock shall be square cut and filled with concrete. Over excavation shall be filled with concrete at no additional cost to the Owner.
   12. Correct areas that are over-excavated and load-bearing surfaces that are disturbed.
   13. Remove excavated material that is unsuitable for re-use from site.
   14. Remove excess excavated material from site.

1.4 EXCAVATION LIMITS

A. The Contractor shall provide temporary sheeting, bracing, shoring or trenches as necessary to protect adjacent structures and provide safe working conditions.

B. Rock and boulders shall be removed to provide a clearance of six inches (6-in.) below and one foot (1-ft.) on each side of all pipes.

C. Limits of trench excavation shall be as shown on the applicable trench details given on the Contract Drawings. Unstable and/or unsuitable soils revealed at the trench bottom shall be removed and replaced with specified material as direct by the Owner's Representative.

1.5 REMOVAL AND STORAGE OF MATERIALS

A. In the event more material is excavated from any trench than can be backfilled over the completed pipe or can be stored within the project limits leaving space for drainage, the excess material shall be removed to some convenient place, provided by the Contractor. The Contractor shall bring back as much of the material so removed as may be required to properly backfill the trench, if of the proper kind; or if so required, the Contractor shall furnish such other suitable materials as may be necessary, as part of its base bid.

B. When it is necessary to haul soft or wet materials over the roads, the Contractor shall provide suitable tight vehicles to prevent spillage.

C. All topsoil shall be removed from the limits of trenches before the commencement of trench excavation. After the trenches are backfilled, the topsoil shall be replaced. No additional compensation will be made to the Contractor for this removal and replacement of topsoil. No topsoil shall be removed from the site.

PART 2 - PRODUCTS

1.6 FILL AND BACKFILL MATERIALS

A. Materials required for backfilling shall be as specified in Section 31 20 00; Earthmoving and as shown on the Contract Drawings, unless otherwise directed by the Owner's Representative.

B. Material testing requirements for bedding and backfill shall be as specified in Section 31 20 00; Earthmoving. The Owner's Representative reserves the right to inspect proposed sources of off-site material and to order such tests of the material deemed necessary to ascertain its quality and gradation of particle size. If similar tests of the material from a particular source were performed previously, the Contractor may submit results of these tests to the Owner's Representative for consideration.

C. No backfill material shall be used on this project until approval is obtained from the Owner's Representative and only material from approved sources shall be used.

PART 3 - EXECUTION

1.7 PIPE BACKFILL REQUIREMENTS

A. Trenches shall be backfilled immediately after installing the pipe. The pipe laying operation may be held up by the Owner's Representative if the backfill operation does not follow immediately.

B. Bedding and Backfill Around Pipe
   1. All pipe beds shall be hand shaped and of the material as shown on the detail sheet.
   2. When conditions warrant, bedding material shall be used within rock, unstable trench bottom conditions, and areas of over excavation.
   3. Bedding material shall be deposited up to the springline of the pipe, completely encasing the lower half of the pipe. The material shall then be thoroughly hand compacted to the specified density out to the side of the trench wall.
   4. Bedding and backfill shall be placed in maximum loose lift thicknesses of 6-inches where the use of hand compaction equipment is necessary. Lifts shall be placed in nearly horizontal orientation.

C. Trench Backfill and Maintenance
   5. Backfill material shall be deposited in nine-inch (9-inch) maximum lifts and thoroughly compacted to the densities as specified. Lifts shall be placed in nearly horizontal orientation.
   6. It is important that the trench is relatively dry during the backfill operation and that the trench be backfilled immediately after installation and backfill around the pipe is completed. The method of consolidation shall be dependent upon the type of backfill material and the finished ground surface above the trench.

D. Special Backfill Requirements
   7. Where existing utilities are exposed during construction, the Owner's Representative may require that a timber or steel beam be installed under the exposed line with both ends set on undisturbed ground and intermediate supports and blocking set as directed.

1.8 COMPACTION and TESTING

A. Backfill shall be compacted in accordance with Section 31 20 00; Earthmoving.

B. Quality control testing shall be in accordance with Section 31 20 00; Earthmoving.

1.9 WASTE MATERIAL DISPOSAL

A. Excess excavated material, debris, waste construction materials shall be properly disposed of. The Contractor shall transport and dispose of all excess material at an approved site and shall be responsible for all transportation and disposal costs.

1.10 SITE GRADING

A. Unless otherwise indicated on the plans, the construction site shall be returned to original ground surface elevations or the grades shown on the Contract Drawings.

B. Lawn areas disturbed shall be backfilled to within the specified distance of the original grade and filled the remainder of the way with topsoil, previously stockpiled from the area or imported from an approved source.

C. Seeding and final site restoration shall be in accordance with the Contract Drawings and section 329219; Seeding.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Temporary Structural Measures
   2. Permanent Structural Measures
   3. Vegetative Measures
   4. Biotechnical measures
   5. Diversion Channels.
   6. Rock Energy Dissipator.
   7. Paved Energy Dissipator.
   8. Rock Basin.
   9. Rock Barriers.
   10. Sediment Basins.
   11. Sediment Traps.

1.3 REFERENCES

A. New York State Standards and Specifications for Erosion and Sediment Control, current version as published by the New York State Department of Environmental Conservation.

B. New York State Department of Environmental Conservation SPDES General Permit for Stormwater Discharges from Construction Activity, current version, as published by the New

1.4 SUBMITTALS

A. Submittals for this Section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

B. Manufacturer's installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Trained Contractor Documentation:
   1. For each Trained Contractor, submit copy of completion certificate or card for NYS Department of Environmental Conservation endorsed Erosion & Sediment Control training.

E. Product Data: Submit data on temporary and permanent erosion and sediment control measures.

F. Submit proposed mix design for review prior to commencement of Work.

G. Test Reports: Indicate certified tests results for precast concrete at manufacturing facility, cast-in-place concrete in field, and granular backfill.

1.5 QUALITY ASSURANCE

A. Perform Work according to NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL by NYS Department of Environmental Conservation (i.e., Bluebook) standards.

1.6 PRE-INSTALLATION MEETING

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not place grout when air temperature is below freezing.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

1.8 RESPONSIBILITY

A. Comply with all applicable NYSDEC regulatory requirements.

B. During construction conduct operations to prevent damage to any water body from pollution by debris, sediment, chemical or other foreign material, or from the manipulation of equipment and/or materials in or near a stream or ditch flowing directly to a stream. Any water which has been used for wash purposes or other similar operations that becomes polluted with sewage, silt, cement, concentrated chlorine, oil, fuels, lubricants, bitumens, or other impurities shall not be discharged into any water body.

C. In the event of conflict between these specifications and the regulation of other Federal, State, or local jurisdictions, the more restrictive regulations shall apply.

1.9 DESCRIPTION

A. The Work shall consist of furnishing, installing, inspecting, maintaining, and removing erosion and sediment control measures as shown on the contract documents or as ordered by the Director's Representative during the life of the contract to provide erosion and sediment control.

B. Temporary structural measures provide erosion control protection to a critical area for an interim period. A critical area is any disturbed, bare slope subject to erosion. These are used during construction to prevent off-site sedimentation. Temporary structural measures shall include:
   1. Construction road stabilization
   2. Stabilized construction access
   3. Dust control
   4. Sediment basin
   5. Sediment trap
   6. Silt fence
   7. Erosion control matting
   8. Storm drain inlet protection
   9. Straw/hay bale dike
   10. Other permanent structural measures as required by the SWPPP.

PART 2 - PRODUCTS

2.1 GEOTEXTILE MATERIALS

A. Geotextile Fabric: As specified in Section 310001 Earthwork Materials.

2.2 SOIL MATERIALS

A. Soil Backfill: As specified in Section 310001 Earthwork Materials.

2.3 PLANTING MATERIALS

A. Soil Supplements: As specified in Section 329200 Turf and Grasses.

B. Seeding: Temporary or permanent, as specified in Section 329200 Turf and Grasses.

C. Mulch: As specified in Section 329200.

2.4 PIPE MATERIALS

A. Pipe: Plastic, as specified in Section 334200 Stormwater Conveyance.

PART 3 - EXECUTION

3.1 SEDIMENT TRAP

A. Clear site as specified in Section 310000 Earthwork.

B. Construct trap by excavating and forming embankments as specified in Section 310000 Earthwork.

C. Place coarse aggregate or rock at outlet as indicated on Drawings.

D. Place geotextile fabric, as specified for rock energy dissipator.

E. When required, obtain borrow excavation for formation of embankment.

F. On entire sediment trap area, apply soil supplements and sow seed, as specified in Section 329200 Turf and Grasses and Section 329300 Plants.

G. Mulch seeded areas with hay as specified in Section 329200 Turf and Grasses and Section 329300 Plants.

3.2 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
   1. During non-germinating periods, apply mulch at recommended rates.
   2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 329200 Turf and Grasses and Section 329300 Plants at 80 percent of permanent application rate with no topsoil.
   3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 329200 Turf and Grasses and Section 329300 Plants permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.3 FIELD QUALITY CONTROL

A. Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Compaction Testing: As specified in Section 310000.

D. Compaction Testing: In accordance with ASTM D1557.

E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.4 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

B. Do not damage structure or device during cleaning operations.

C. Do not permit sediment to erode into construction or site areas or natural waterways.

D. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.5 PROTECTION

A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit construction traffic over paving for 7 days minimum after finishing.

C. Protect paving from elements, flowing water, or other disturbance until curing is completed.

3.6 WORK AREAS

A. Schedule the work so as to minimize the time that earth areas will be exposed to erosive conditions. Provide temporary structural measures immediately to prevent any soil erosion.

B. All erosion and sediment control devices must be maintained in working order until the site is stabilized. All preventative and remedial maintenance work, including clean out, repair, replacement, re-grading, re-seeding, or re-mulching, must be performed immediately.

C. After final stabilization has been achieved temporary sediment and erosion controls must be removed. Areas disturbed during removal must be stabilized immediately.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Hot-mix asphalt patching.
   2. Hot-mix asphalt paving.
   3. Cold milling of existing hot-mix asphalt pavement.
   4. Hot-mix asphalt paving overlay.

B. Related work as specified elsewhere:
   3. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.03 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.04 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

E. Except for materials indicated to be stockpiled, reinstalled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Qualification Data: For qualified manufacturer and Installer.

C. Material Certificates: For each paving material, from manufacturer.

D. Material Test Reports: For each paving material.

E. Environmental Product Declarations: Provide current Environmental Product Declarations (EPDs), that include the amount of embodied carbon in the asphalt paving.
   1. Acceptable EPDs are non-expired, Product-specific, Facility or Plant-specific, or Supply Chain-specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services*.
   2. Provide the EPD Material Tracking Form containing the total anticipated quantity/volume/weight (matching the units used in the EPDs) of each product being incorporated into the project.
   3. With each application for payment, provide an updated EPD Material Tracking Form and copies of delivery tickets for each product incorporated into the project for the period covered by the payment application.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by NYSDOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NYSDOT for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. Preinstallation Conference: Conduct conference at Project site prior to marking pavement.
   1. Review methods and procedures related to pavement marking including, but not limited to, the following:
      a. Review proposed paving marking materials.
      b. Review condition of existing asphalt surface and preparatory work.
      c. Review requirements for protecting pavement marking work, including restriction of traffic during installation period and for remainder of construction period.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

B. Chip Seal: Chip Seal shall be placed during the period from May 1st through September 7th. Material shall not be applied to a pavement surface when the:
   1. Surface has standing water or is saturated.
   2. Surface temperature is less than 60°F.
   3. Ambient temperature is less than 50°F.
   4. Weather conditions would prevent proper construction of the chip seal.

C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for oil-based materials 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C):

PART 2-PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.02 ASPHALT MATERIALS

A. Asphalt Binder:
   1. PG 64V-22 for roadways and parking.
   2. PG 64S-22 for sidewalks, driveways, and patching.
   3. Poly-phosphoric acid is prohibited.

B. Asphalt Cement: Per NYSDOT Standard Specifications.

C. Truing and Leveling Course: Asphalt surface course material may be utilized for truing and leveling.

D. Tack Coat: Per NYSDOT Standard Specifications.

E. Water: Potable.

2.03 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by NYSDOT:
   1. Binder Course: Superpave 19mm F9 Binder Course HMA, 80 Series Compaction (Item 402.197904)

2.04 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Joint Sealant: Hot-applied, single-component, polymer-modified bituminous sealant in accordance with NYSDOT Item 418.7603.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.02 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.03 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.04 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 SHOULDER EDGES

A. Where indicated or where pavement does not abut curbing or other structures, the Contractor shall construct a shoulder edge wedge as detailed in the contract documents. The asphalt mixture shall be placed on pavement shoulders where the outside edge of top and binder courses consisting of an angle of 35 degrees or flatter measured from finished grade to the preceding course surface.
1. The shoulder edge wedge shall be constructed using a device attached to the screed to minimize hand work.
2. The top of the tapered section shall be at the end of pavement width such that the tapered section will be an additional width of material outside of the pavement width.

3.06 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections and in accordance with NYSDOT Standard Sheets. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

3.07 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.08 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances.
1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
1. Surface Course: 1/8 inch (3 mm).
2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

B. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow milled materials to accumulate on-site.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Concrete Walkways.
   2. Charging Station Pads.
   3. Sculpture Pads.

B. Related work as specified elsewhere:
   3. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

E. Except for materials indicated to be stockpiled, reinstalled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.05 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Qualification Data: For manufacturer.

D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Admixtures.
   4. Curing compounds.
   5. Applied finish materials.
   6. Joint fillers.
   7. Joint sealants.
   8. Detectable warning plates.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

F. Shop drawings for pavement scoring and/or product material data for formwork for radii.

1.06 QUALITY ASSURANCE

A. Installer Qualification: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Finisher Certifications: A minimum of one finisher or finishing supervisor shall be currently certified as an ACI Flatwork Concrete Finisher when installing all exterior exposed concrete flatwork.

C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
   2. Comply with ACI and NYSDOT requirements for manufacturers of ready-mix concrete products.

D. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

F. Concrete Testing Service: Owner to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete producer.
   d. Concrete pavement subcontractor.

1.07 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2-PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

B. Curved Form Materials: Modular, reusable, high density polyethylene or steel forms designed for the purpose of forming curved concrete installations.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60 (Grade 420), plain steel bars.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

D. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

E. Dowel alignment system:
1. Speed Load two component dowel alignment system by Greenstreak Inc, 800-325-9504, or approved equal.
2. Sleeve and Base:
   a. PSD12/#4TX 5/8" Smooth or #4 Rebar X 24", base PSD/#4BX.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
1. Portland Cement: ASTM C 150, Type I/II.
   a. Fly Ash: ASTM C 618, Class F.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or white burlap-polyethylene sheet.
   1. Available Products:
      a. BurLene, by Max Katz Bag Company, Inc., http://www.maxkatzbag.com.
      b. UltraCure DOTTM Disposable Wet Cure Blanket, as provided by McTech Group, Inc., http://www.mctechgroup.com.
      c. conKure X80W Wet Curing Blanket, by Raven Industries, www.ravenefd.com.
      d. Approved equivalent.

B. Water: Potable.

C. Transparent Acrylic Water-Based Curing, Sealing and Dustproofing compound:
   1. Available Products:
      a. Masterkure N Seal W by Kure-N-Seal W by Sonneborn/BASF.
      b. Kure-N-Seal WB.
      c. Approved Equivalent.

D. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, specifically manufactured for colored concrete.
   1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
   2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.
   3. Available Products:
      a. Increte Systems Inc.; Cure Crete.
      b. QC Construction Products; Color Cure.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, specifically manufactured for use with colored concrete.
   1. Available Products:
      a. Burke by Edoco; Cureseal 1315 WB.
      b. ChemMasters; Polyseal WB.
      c. Conspec Marketing and Manufacturing Co., Inc.; Sealcure 1315 WB.
      d. Euclid Chemical Company (The); Super Diamond Clear VOX.
      e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
      f. Lambert Corporation; UV Safe Seal.
      g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
      h. Meadows, W. R., Inc.; Vocomp-30.
      i. Metalcrete Industries; Metcure 30.
      j. Symons Corporation; Cure & Seal 31 Percent E.
      k. Tamms Industries, Inc.; LusterSeal WB 300.
      l. Unitex; Hydro Seal 25.
      m. Vexcon Chemicals, Inc.; StarSeal 1315.

F. Clear Acrylic Sealer: Manufacturer's standard waterborne, membrane-forming, medium-gloss, acrylic copolymer emulsion solution, specifically manufactured for colored concrete, containing not less than 15 percent solids by volume, nonyellowing, and UV resistant.
   1. Available Products:
      a. Advanced Surfaces, Inc.; Clear Sealer - Water Base.
      b. Bomanite Corporation; Sealer - Water-Based.
      c. Cobblecrete International; Acrylic Sealer Water Based.
      d. Increte Systems Inc.; Water Based Clear Seal.
      e. Kemiko; Stone Tone Sealer.
      f. Rafco Products; Satinseal.
      g. Scofield, L. M. Company; Cementone Clear Sealer.
      h. Southern Color Company, Inc.; Redi Color Seal Plus.
      i. Stampcrete International Ltd.; WB 6000.
      j. Symons Corporation; Decorative Sealer WB.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

1. Manufacturer & Color or equivalent

a. Solomon Colors, Inc, powdered integral concrete colors: Charcoal #920

C. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).

1. Available Products:
   a. Burke by Edeco; True Etch Surface Retarder.
   b. ChemMasters; Exposee.
   c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
   d. Euclid Chemical Company (The); Surface Retarder S.
   e. Kaufman Products, Inc.; Expose.
   f. Metalcrete Industries; Surftard.
   g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
   h. Scofield, L. M. Company; Lithotex.
   i. Sika Corporation, Inc.; Rugasol-S.
   j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

2.07 CAST IRON ADA DETECTABLE WARNING PLATES

A. Available Manufacturers, or approved equal: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Syracuse Castings.
   a. Product: ADA Compliant Detectable Warning Plates.
2. Neenah Foundry.
   a. Product: R-4984.
3. East Jordan Iron Works.
   a. Product: Duralast Detectable Warning Plates.

B. Size and shape: 24” x 24” or 24” x 30”. No sides less than 24” wide after cutting ends. Provide radius products when specified along radius curbing.

C. Color: Natural.

2.08 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range, water-reducing and retarding admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

2.09 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3-EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
   3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) require correction according to requirements in Division 31 Section "Earth Moving."

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least 12", and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
   1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   2. Doweled Joints: Install dowel bars and alignment sleeve assemblies at joints where indicated.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 50 feet (15.25 m) maximum, unless otherwise indicated on the plans.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Doweled Contraction Joints: Install dowel bars and alignment sleeve assemblies at joints where indicated. Lubricate one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch (10-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer or use bonding agent if approved by Landscape Architect.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Curbs: When automatic machine placement is used for curb placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

3.08 SEALER

A. Exterior Sealer: Apply two (2) coats of specified sealer to exterior concrete slabs, walks, landings, steps, walls, ramps and curbs according to manufacturer's directions. Apply uniformly in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Compound: Apply curing compound immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after application. Maintain continuity of coating and repair damage during curing period.
   1. Cure integrally colored concrete with a pigmented curing compound.
   2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.

3.10 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follow:
   1. Elevation: 1/4 inch (6 mm).
   2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
   3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
   5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
   6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
   8. Joint Spacing: 3 inches (75 mm).
   9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
   10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

D. Test results shall be reported in writing to Landscape Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and

inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Landscape Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Landscape Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Landscape Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Granite curb.
   2. Flush granite curb.
   3. Landscape granite curb.

B. Related work as specified elsewhere:
   1. Division 31 Section “Earth Moving” for trenching, bedding, and backfilling.
   2. Division 32 Section “Asphalt Paving.”
   3. Division 32 Section “Concrete Pavement.

1.03 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated.

C. Notify utility locator service for area where Project is located before site clearing.

D. Except for materials indicated to be stockpiled, reinstalled or to remain Owner’s property, cleared materials shall become Contractor’s property and shall be removed from the site.

1.04 SUBMITTALS

A. Product Data: Samples of color and finish.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Provide stone curbing according to the materials, workmanship, and other applicable requirements of the New York State Department of Transportation (NYSDOT) Standard Specifications, Construction and Materials.

B. Installer Qualifications: Engage an experienced installer who has completed stone curbing installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Single Source Responsibility: Obtain stone curbing from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying progress of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect stone curbing during storage and construction against soiling or contamination from earth and other materials.

B. Protect grout and mortar materials from deterioration by moisture and temperature. Store in a dry location or waterproof container.

1.07 PROJECT CONDITIONS

A. Site Information: Perform site survey and layout for curbing. Verify that straight length, radius, and drop curbing sections may be installed in compliance with drawings and referenced standards.

B. Weather Limitations: Protect mortar material against freezing when ambient air temperature is 40 degrees F and falling. Heat materials and provide temporary protection of completed joints.

C. Sequencing and Scheduling: Coordinate stone curbing work with location and alignment of roadways, parking lot entrances, traffic islands, walks, and drainage inlets.

PART 2-PRODUCTS

2.01 STONE CURBING

A. Standard Curb: Granite, complying with the requirements of NYSDOT Specifications 714-01 for Stone Curb.
   1. Size: 5 inches wide by 16 inches deep.
   2. Finish: Sawn top, split face battered front.
   3. For radii less than 100 feet, a radiused curb shall be provided.

B. Flush curb : Granite, complying with the requirements of NYSDOT Specifications 714-01 for Stone Curb.

C. Concrete Backing and Bedding: Portland cement concrete, 3,000psi mix.

D. Mortar: Cement mortar complying with the requirements of NYSDOT Specifications 705-20.

PART 3-EXECUTION

3.01 INSTALLATION

A. Do not use stone curbing with cracks, voids, discolorations, and other defects that might be visible in the finished work.

B. Place stone curbing on a continuous concrete backing in accordance with NYSDOT Specifications 609-3.01.

C. Set stone curb on true line and grade to provide a minimum 4- inch and maximum 6-inch reveal above final pavement elevations and fit no closer than 1/4 inch at the Aris line.

D. Fill all joints solid with cement mortar and remove excess mortar from exposed faces of stone curbing.

E. Backfill, after cement has properly set, with material indicated for applicable pavement section.

F. Saw-cut transition angle from standard face curb to traversable curb per contract documents.

3.02 FIELD QUALITY CONTROL

A. Tolerances: Provide completed stone curbing installation that does not exceed the following deviations from specifications and alignments indicated:
   1. Curb Reveal: Plus or minus 3/8 inch.
   2. Curb Grade: 1/4 inch per 10 feet.
   3. Horizontal Alignment: Within 2 inches.
   4. Elevation: Within ½ inch at any point.

3.03 PROTECTION

A. Cleaning: Remove any visible stains and excess mortar from exposed surfaces, wash and scrub clean.

B. Protect the installed curbing from chipping, staining, displacement or other damage during backfilling and paving operations.

END OF SECTION

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.

1.02 SUMMARY

A. Section includes ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts.

1.03 SUBMITTALS

A. Product Data: For components and accessories.

B. Shop Drawings: Layout, dimensions, spacing of components and anchorage, and installation details.

C. Samples for Verification: 8 by 10inch minimum sample of fence panel illustrating design, fabrication workmanship, and selected color coating.

D. Copy of warranty.

1.04 QUALITY ASSURANCE

A. Installer Qualification: An experienced installer who has completed installation of aluminum louver fencing and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer/ Fabricator Qualifications: Experienced product manufacturer for more than 30 years.

C. Warranty
   1. Provide in accordance with closeout procedures: 10 years warranty for factory finish against cracking, peeling, and blistering under normal use.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in original undamaged packaging in a dry location until ready for installation.

B. Handle products carefully to prevent any damage to the finishes.

PART 2-PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. AMETCO Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096: 800-362-1360.

B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 63 00 - Product Substiution Procedures.

2.02 MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

2.03 FENCE SYSTEM

A. Type: Ornamental fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts; Eclipse Aluminum Fixed Louver Fencing, 80% visual screening as manufactured by Ametco Manufacturing Corporation.

B. Fence Panel
   1. Fixed louver bars: Extruded aluminum louver bars, 1-31/32 inches wide, spaced at 2-1/16 inches. Extend louver flange to allow 80% direct visual screening.
   2. Cross bars: 1/2 x 1/8 inch flat bars welded perpendicular to back side of louver bars and spaced at 18inches.
   3. Panel height: As indicated on drawings.
   4. Panel width: As indicated on drawings.

C. Posts
   1. Type: 4” x 4” extruded tubular aluminum sections with solid aluminum caps.
   2. Length: As indicated on drawings.

2.04 FACTORY FINISH

A. Aluminum fence panels and posts shall receive polyester powder coating.

B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
   1. Minimum hardness measured in accordance with ASTM D3363: 2H.
   2. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.
   3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5% salt spray at 95 degrees F and 95% relative humidity and after 1000 hours less than 3/16 inch undercutting.
   4. Weather-ability tested in accordance with ASTM D822: No film failure and 88% gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

C. Color: Selected by Owner from manufacturer's standard range.

PART 3-EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance. Field Verify required dimensions
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Cast concrete footings in accordance with Section 03 30 00 - Cast-In-Place Concrete as detailed on drawings and approved shop drawings.
   1. Minimum footing diameter for terminal and intermediate posts: 12 inches.
   2. Minimum footing depth: 4'-0"
   3. Allow 12 inches embedment of posts.

3.02 INSTALLATION

A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.

B. Install fence posts plumb and level by setting post in hole cast in concrete and grouting solid. Temporarily brace fence posts with 2 by 4 wood supports until grout is set.

C. Do not install bent, bowed, or otherwise damaged panels. Removed damaged components from site and replace.

D. Secure fence panels with standard stainless steel bolts to fence posts prior to setting posts in footings.

E. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Bollards.
   2. Bicycle Racks.
   3. Concrete Seatwall with Integrated Seating

1.03 SUBMITTALS

A. Product Data: Include physical characteristics such as shape, dimensions, and finish for building materials.

B. Shop Drawings: Provide dimensional drawings and installation instructions for all product.

C. Samples for Verification: For each product, provide samples for all material finishes.

D. Maintenance Data: For each product.

1.04 QUALITY ASSURANCE

A. Installer Qualification: An experienced installer who has completed installation of site furnishings and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer/ Fabricator Qualifications: Experienced product manufacturer for more than 30 years.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in original undamaged packaging in a dry location until ready for installation.

B. Handle products carefully to prevent any damage to the finishes.

PART 2-PRODUCTS

2.01 BOLLARDS

A. Bollard Pipe Construction: Fabricated from A36 steel and filled with concrete.
   1. Overall Length: 72 inches.
   2. Overall Width: 4” diameter I.D. (4-1/2” O.D.).
   3. Installation Method: Cast in concrete. Fill all bollards with concrete.
   4. Finish: Rust inhibiting primer.

B. Bollard Sleeves.
   1. Type 316 stainless steel bollard sleeve, product R-7301 by Reliance Foundry or approved equivalent.
   2. Diameter: 6 inches.
   3. Height: 36 inches.
   4. Finish: Powder coated.
   5. Color: Black.

2.02 BICYCLE RACK

A. Manufacturer: Subject to compliance with requirements, provide Bicycle Rack HD: Cornell Hoop by Dero or comparable product.

B. Product: Bicycle Rack HD: Cornell Hoop by Dero.

C. Overall Length: 30”

D. Overall Height: 42-1/2”

E. Finish: Powder coated.

F. Installation method: In-ground.

2.03 CONCRETE SEATWALL WITH INTEGRATED SEATING

A. Manufacturer: Subject to compliance with requirements, provide Large Bench with Two Double Seats by Wausau Tile or comparable product.

B. Product: Large Bench with Two Double Seats by Wausau Tile, Product No. ZB.WL.10.

C. Overall Length: 96”

D. Overall Width: 20”

E. Overall Height: 20”

F. Finish: Color and finishes to be chosen from full selection by owner.

G. Installation method: Surface Mount to be coordinated with manufacturer.

PART 3-EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install each item in accordance with component manufacturer's instructions.

B. Contractor shall provide a crane or fork-lift intended for the weight of the Portable Building and gates. Manufacturer will assist the Owner by providing correct minimum lifting capacity and by locating lift points and recommended lifting capacities.

C. Set all items Plumb and level

D. The two sides of the Vehicular Swing Gate at the southern entrance shall be at equal elevation.

3.03 ADJUSTING AND CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace components.

B. Adjust gates, salt shed components, and all hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

C. Lubricate hardware and other moving parts.

D. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of the Section. Cooperate with such trades to assure steady progress of all work under the Contract.

1.2 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for planting soil including, but not limited to the following:
   1. Soil preparation for imported soils including testing for conformance.
   2. Soil amendments.
   3. Subgrade percolation testing.
   4. Installation and placement of soils.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 31 Section “Site Clearing” for stripping and stockpiling topsoil.
   2. Division 32 Section “Earthwork” for excavation, filling, rough grading, and backfill.
   3. Division 32 Section “Turf and Grasses” for planting soil mix placement.
   4. Division 32 Section “Plants” for planting soil mix placement.

C. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

1.3 REFERENCES

A. ANSI: American National Standards Institute.

B. AOAC: Association of Official Agricultural Chemists.

C. ASA: American Society of Agronomy.

D. ASTM: American Society for Testing Materials.

E. USDA Soil Texture System of Classification.

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Planting Soil: Stockpiled or imported topsoil and/or subsoil mixed with soil amendments for planting trees, shrubs, ground covers and lawn.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

E. Subsoil: All soil beneath the topsoil layer of the site soil profile, and typified by the lack of organic matter and soil organisms. Subsoil is unsuitable for plant growth unless amended as specified.

F. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

1.5 SUBMITTALS

A. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
   1. Landscape Architect shall reserve the right to reject any soil supplier.
   2. Soil mix supplier shall have a minimum of five years’ experience at supplying custom planting soil mixes.
   3. Submit supplier name, address, telephone and fax numbers and contact name.
   4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

B. Samples: Prior to installing soil mixes, submit representative samples to Landscape Architect for approval. Do not place any soil mixes until Landscape Architect’s approval has been obtained.
   1. Imported sandy loam soil mix.

C. Compost:
   1. Product Data: For each type of product indicated, including source.
   2. Certificates: Provide certificates required by authorities having jurisdiction, especially for any composted materials containing sewage sludge. Approval as EPA Type 1 “exceptional quality” is required as well as that of the State of New York.
   3. Testing: As described in Quality Assurance.

D. All Other Amendments: Product Data.

E. Subgrade Testing:
   1. Field percolation test results as described in Part 3 Execution. Percolation tests shall be measured in inches per hour of drainage.

F. Imported Planting Soil Mixes: The following testing is required of all soil mixes comprised of imported soil materials:
   1. Particle Size Analysis: Include sand, silt and clay, sand size distribution, sand particle shape, pH, uniformity coefficient by hydrometer method (ASTM D-422-63).
   2. Organic Matter: Percent organic matter by combustion (ASTM F-1647, Method 1).

3. Report suitability of soil mixes for turf and plant growth. Verify compliance with recommended quantities of nitrogen, phosphorus, potassium, nutrients and soil amendments to be added to produce satisfactory topsoil.
4. Test results for soil mixes must be accepted prior to placement.

1.6 QUALITY ASSURANCE

A. Source Limitations for Topsoil and Planting Soil Mix: Obtain all topsoil and/or planting soil mix through one source that has been tested according to the requirements below. If there are any additional proposed sources, Contractor must provide topsoil analysis and testing for each source as described below.

B. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
1. Landscape Architect shall have the right to reject any soil supplier.
2. Soil mix supplier shall have a minimum of five years' experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone and fax numbers and contact name.

C. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

D. Soil-Testing Laboratory Qualifications: Proposed planting mix shall be tested by the following:
1. Cornell Nutrient Analysis Lab
c/o Soil Health Lab
G01 Bradfield Hall
306 Tower Rd.
Ithaca, NY 14853
soilhealth@cornell.edu
http://soilhealth.cals.cornell.edu
607-227-6055

E. Percolation Testing of Subgrade: Prior to placement of the planting soil, test the subgrade as described in this Section. Coordinate the testing of the subgrade for percolation with the Sitework Contractor, Owner's Representative, and Landscape Architect.

1.7 DELIVERY, STORAGE AND HANDLING

A. Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than at field capacity. The Landscape Architect shall be consulted to determine if the soil is too wet to handle.

B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

C. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.

D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.

E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall be placed in mounds less than six feet high. If soil stockpiles greater than six feet high are present longer than two weeks, then the contractor shall break down and disperse soil so that mounds do not exceed the six-foot height restriction for longer than two weeks.
1. Provide silt fencing around topsoil mounds, and/or as directed in the Storm Water Pollution Prevention Plan (SWPPP).

F. Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after a heavy rain, nor when frozen. Soil shall be handled only when the moisture content is less than field capacity.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; clean and screened free of deleterious materials and weeds, including but not limited to any plant listed by NYSDEC or other authority as invasive, nuisance or noxious weed species; and free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.
1. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources only if required due to deficit of existing soil materials. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

2.2 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests. **Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight.**
1. Organic Matter Content: 50 to 60 percent of dry weight. (ASTM F-1647, Method 1).
2. The ratio of carbon to nitrogen shall be in the range of 10:1 to 25:1.
3. One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. (ASTM D-422-63).
4. pH: The pH shall be between 5.5 to 7.5 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter. (American Society of Agronomy Methods of Soil Analysis, Part 2, 1986).
5. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall not exceed 4.0 mmhos/cm (dS/m).
6. Heavy metal contents shall conform to state and federal regulations.

7. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Compost may be obtained at one of the following sources, provided that the test requirements are met:
1. WeCare Compost by We Care Organics, Jordan, New York, 315-689-1937
2. Cayuga Compost (fine) by P&S Excavating, Trumansburg, New York, 607-387-6826
3. Cornell Farm Services, Ithaca, NY: 607-257-2235
4. CJ Krantz Organics, Clarence Center, NY, 716-741-3850
5. Fessenden Farms, King Ferry, NY, 877-767-7280
6. Approved equivalent.

2.3 SAND

A. Sand: Clean AASHTO M-6 or ASTM C-33 concrete sand.

U.S. Sieve Size No.	% Passing Mini-mum	% Passing Maxi-mum
¾ in	100	
4	95	100
8	80	100
16	50	85
30	25	60
50	5	30
100	0	10

1. Sand substitutions such as Diabase and Graystone #10 are not acceptable. No calcium carbonated or dolomitic sand substitutions are acceptable. “Rock dust” cannot be substituted for sand.

2.4 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.5 Soil Mixes, General

A. All mixes shall meet the following criteria:
1. Free of stones ½”, stumps, roots and other woody material over 2” in diameter
2. Free of brush and seeds from noxious weeds.
3. pH 5.5 to 7.2
4. Soluble salts <500 ppm

2.6 TURF SOIL MIX

A. Turf soil shall be a loamy sand as defined by USDA Soil Texture System of Classification created from combination of accepted sand, topsoil, and compost meeting the following criteria:
1. By volume:
3 parts sand
2 parts topsoil
1 part compost
2. % passing #270 sieve11-14%
3. Uniformity ratio D70/D20 <4.5
4. Permeability >4” inch per hour
5. pH 5.5 to 7.2
6. Organic Matter 4-5%
7. Compaction: 86-88% max.

B. Cornell Soil Health Assessment Overall Quality Score of 70 or above, with all sub-indicator test ratings scoring 30 or above.

2.7 PLANTING SOIL MIX

A. Planting soil mix shall be a **loam** as defined by USDA Soil Texture System of Classification created from combination of accepted sand, topsoil, and compost meeting the following criteria:
1. By volume:
2 parts sand
1 parts topsoil
2 part compost

2. % passing #270 sieve11-16%
3. Uniformity ratio D70/D20 <6.0
4. Permeability >3" inch per hour
5. pH 5.5 to 7.2
6. Organic Matter 6-9%

B. Cornell Soil Health Assessment Overall Quality Score of 70 or above, with all sub-indicator test ratings scoring 30 or above.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting or turf soil mix until all work in adjacent areas is complete and approved by the Landscape Architect.

B. Examination of Subgrade: The subgrade shall be inspected prior to the start of soil placement for conformance with the Drawings for elevations of subgrade relative to finish grade. Subgrade shall be graded smooth and parallel to the finish grades unless otherwise noted in the Drawings.

C. Pre-Grading Inspection: Prior to the commencement of Work, contact the Landscape Architect to provide an inspection to verify the tree root protection zones. Make corrections and adjustments as directed by the Landscape Architect prior to commencing any work.

3.2 SUBGRADE DRAINAGE TESTING

A. Perform subgrade percolation testing at a frequency of one percolation test for every 1,000 sq. ft. of installed topsoil area and at all bioretention planting beds. Percolation tests shall be performed on a minimum of 10% of tree pits and 20% of shrub beds, and on any areas of questionable drainage or as required by Landscape Architect. Contact Landscape Architect and conduct percolation tests in his or her presence. Percolation tests shall be measured in inches per hour of drainage at the base of the plant root level.

1. Excavate test pits 36" by 36" by 18" deep.
2. Fill test pit with 12" minimum depth water and allow water to naturally drain out. When water has drained out, fill excavation again with 12" minimum depth water and measure rate of drainage. Drainage rate should be a minimum of 1" per hour (1 inch drop in water elevation per hour test pit).
3. Should any planting areas yield a percolation test result of less than 1" of drainage per hour, stop work on these areas and obtain direction from Landscape Architect prior to installation of planting mixes and amendments.

3.3 MIXING OF SOIL MIXES

A. General Soil Mix Preparation: Examine soil and remove foreign materials, stones over 1/2", and organic debris over 2" in length. All preparation and mixing shall be accomplished when the soil moisture content is less than field capacity.

B. Adequate quantities of mixed planting soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.

1. Minimum depths of mixed soils must be achieved per planting details. Contractor shall remove excess soils from site as needed at no additional cost.

C. Soil mixes shall be produced with equipment that blends together each component in a thorough and uniform manner.

1. Soil mixing can occur in-place or off-site.

3.4 SOIL PREPARATION TECHNIQUES

A. Protection of Existing Soils: Protect existing in-place soils and vegetation.

1. Applicability: All areas within the Project Limit Line that are to remain undisturbed by all construction activities including topsoil stripping, grading, excavation, backfill, staging and stockpiling shall be protected by the following:
   a. Enclose area with chain link protection fence. Fence line shall be maintained throughout the duration of the Work.

B. Amendment of Existing Soils: Amend in-place soils and subsoils as follows:

1. Applicability: All areas designated for lawns and planting beds that have been rough graded and/or backfilled shall be treated as follows:
   a. Scarify or till subgrade to depth needed to achieve required depth of loose soil mix after amending. Entire surface shall be disturbed by scarification. Do not scarify within drip line of existing trees.
   b. Place approved compost directly on existing soil and rototill to thoroughly incorporate at the following ratio:
      1) 1/2" of compost for every inch of existing soil (50% by volume).
      2) Confirm that depth of loose amended soil meets specified design depths per landscape plan and details.
      3) Alternatively, it is the Contractor's option to amend and thoroughly mix excavated existing soils off site and reinstall after scarifying and tilling existing subgrade.
   c. Rake beds to fine grade and remove surface rocks larger than 2 inches in diameter.
      1) In turf areas, roll to compact soil to 85% of maximum density and remove rocks and debris greater than 1 inch in diameter.

C. Imported Topsoil Mixes: Import topsoil and amend to achieve a sandy loam as defined by the USDA Soil Texture System of Classification.

1. Applicability: All areas designated for lawns and planting beds that need additional material to achieve finish grades.
2. Contractor shall manufacture planting soil mix as follows:
   a. Contractor shall procure all soil component materials.

b. Contractor shall obtain laboratory testing services to determine percentages of soil component materials required to manufacture planting soil mix.
c. Mix in fertilizers and amendments as recommended by soil testing laboratory and as approved by the Landscape Architect. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.
d. After component percentages are determined by the Soil Scientist, each planting soil mix shall be tested for physical and chemical analysis.
e. Retest mixed planting soil and adjust mix as necessary to meet project requirements.

3. Placement: Scarify or till subgrade to depth needed to achieve required depth of planting or turf soil mix after amending. Entire surface shall be disturbed by scarification. Do not scarify within drip line of existing trees.
4. Rake beds to fine grade and remove surface rocks larger than 2 inches in diameter.
   a. In turf areas, roll to compact soil to 85% of maximum density and remove rocks and debris greater than 1 inch in diameter.

3.5 COORDINATION AND EXCESS MATERIALS

A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to soil placement.
B. Excess Soil Materials: Remove the excess soil materials from the site at no additional cost to the Owner unless otherwise requested.
   1. Owner shall reserve right of first refusal on all amended soil mixes.

3.6 FIELD QUALITY CONTROL

A. Post-Installation Inspection: Prior to planting, contact the Landscape Architect to provide an inspection verify that the placement of amendments and soil preparation is consistent with the construction documents.
   1. Contractor and Landscape Architect shall verify depth of planting soil placement and/or rototilled amended soil depth prior to installation of plants.
   2. If required depth is not achieved, Contractor shall provide additional rototilling, mixing and compost to achieve specified depth at no cost to the Owner.
B. Provide delivery tickets for soil amendments to verify the quantity of material specified on the construction documents. Make corrections and adjustments as directed by the Landscape Architect.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Establishing Native Wildflower & Raingarden Seed Mixes
   2. Erosion-control materials.

B. Related work as specified elsewhere:
   1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
   2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, rough grading, and aluminum edge restraint.
   3. Division 32 Section “Landscape Soils Preparation” for preparation of soil mixes.

1.03 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Final Acceptance: At the end of the Maintenance Period, Landscape Architect shall reinspect all lawns and meadows to determine whether Satisfactory Lawn has been achieved.

C. Initial Acceptance: Completion of seeding or sodding, with adequacy determined by Landscape Architect. Maintenance period shall commence for 60 days after initial acceptance, and continue until Final Acceptance.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

F. Turf Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

1.03 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated.

C. Notify utility locator service for area where Project is located before site clearing.

D. Except for materials indicated to be stockpiled, reinstalled or to remain Owner’s property, cleared materials shall become Contractor’s property and shall be removed from the site.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Provide stone curbing according to the materials, workmanship, and other applicable requirements of the New York State Department of Transportation (NYSDOT) Standard Specifications, Construction and Materials.

B. Installer Qualifications: Engage an experienced installer who has completed stone curbing installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Single Source Responsibility: Obtain stone curbing from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying progress of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.07 PROJECT CONDITIONS

A. Seeding Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
   1. Spring Planting: April 1 to June 30.
   2. Fall Planting: September 1 to November 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.08 MAINTENANCE SERVICE

A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
   1. Seeded Lawns: 60 days from date of planting completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

PART 2-PRODUCTS

2.01 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:
   1. Seed Mix: Subject to compliance with requirements, provide the following:
      a. North East Native Wildflower Seed Mix. (ERNMX -153-1) https://www.ernstseed.com/product/showy-northeast-native-wildflower-mix/
      b. Rain Garden Mix (ERNMX -180) https://www.ernstseed.com/product/rain-garden-mix/
      c. Seeding Rate: 8 pounds per 1,000 square fee.
   2. Overseeding Mix: Proportioned by weight as follows:
      a. Cover Crop Mix ERNMX-135
      b. Seeding Rate: 3.5 pounds per 1,000 square feet.

2.02 FERTILIZE

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.03 SEEDING MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.04 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3-EXECUTION

3.01 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 SEEDING PREPARATION

A. Refer to Section 329113 Soil Preparation.

B. Newly Graded Subgrades: Decompact subgrade as detailed on drawings. Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Director's property.
   1. Apply fertilizer and amendments as detailed directly to subgrade before loosening.
   2. Thoroughly blend turf soil mix off-site before spreading.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
   3. Spread turf soil mix to a depth as noted in details but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if turf soil or subgrade is frozen, muddy, or excessively wet.
      a. Spread approximately 1/2 the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 2 inches (50 mm) of subgrade. Spread remainder of turf soil mix.

C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
   1. Apply fertilizer directly to surface soil before loosening.
   2. Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
   3. Legally dispose of waste material, including grass, vegetation, and turf, off Director's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.04 PREPARATION FOR EROSION-CONTROL MEASURES

A. Prepare area as specified in "Lawn Preparation" Article.

B. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.05 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   1. Do not use wet seed or seed that is moldy or otherwise damaged.
   2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft. (2.3 to 3.6 kg/92.9 sq. m).

C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where shown, installed and anchored according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
   1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a depth of 3/16 inch (4.8 mm), and roll surface smooth.

3.06 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
   1. Mix slurry with nonasphaltic tackifier.
   2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre (15.6-kg/92.9 sq. m) dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.07 SATISFACTORY SEEDED AREAS

A. Seeding installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Areas: At end of maintenance period, a healthy, uniform, close stand of perennial vegetation has been established, free of non-specified plant material and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).

B. Use specified materials to reestablish areas that do not comply with requirements and continue maintenance until lawns are satisfactory.
   1. Overseed all bare patches exceeding 5 by 5 inches with overseeding seed mix at specified rates.
   2. Contractor shall include watering until satisfactory lawns are achieved, at no additional cost to the Director.

3.08 CLEANUP AND PROTECTION

A. Promptly remove soil and debris, created by lawn work, from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after lawn is established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Trees.
   2. Shrubs.
   3. Plants.
   4. Organic mulches.
   5. Stone mulch.
   6. Edging for mulch.
   7. Tree stabilization.
   8. Trunk guards.
   9. Temporary plant protection fence.
   10. Prefabricated Drainage composites.

B. Related work as specified elsewhere:
   1. Division 31 Section "Site Clearing and Demolition" for protection of existing trees and plantings and site clearing.
   2. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage, drainage backfill materials and separation materials.
   3. Division 32 Section “Landscape Soils Preparation” for mixing planting soils.
   4. Division 32 Section "Turf and Grasses" for lawn and meadow planting.

C. Refer to Drawings for Plant Composition Schedule.

1.03 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.

C. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.

D. Ecoregion: Ecoregions are areas where ecosystems and the type, quality, and quantity of environmental resources are generally similar. The Project site is part of the EPA Level III Eastern Great Lakes and Hudson Lowlands ecoregion.

E. Final Acceptance: At the end of the Maintenance Period, Landscape Architect shall reinspect all plantings to determine satisfactory plant establishment.

F. Finish Grade: Elevation of finished surface of planting soil.

G. Initial Acceptance: Completion of planting, with adequacy determined by Landscape Architect. Maintenance period shall commence for 60 days after initial acceptance and continue until Final Acceptance.

H. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

I. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

J. Planting Soil: Imported topsoil, or manufactured topsoil, mixed with soil amendments.

K. Subgrade: Surface or elevation of subsoil remaining after completing excavation and removal of unsuitable soils, or top surface of a fill or backfill, before placing planting soil.

L. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

1.03 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated.

C. Notify utility locator service for area where Project is located before site clearing.

D. Except for materials indicated to be stockpiled, reinstalled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include sources for all plant materials.

B. Mulch Samples:
   1. Samples shall be submitted to the Landscape Architect for approval, prior to its use in the project. Mulch samples shall be tested for pH, which must be between 4 and 6.
   2. A minimum 50-pound bag is to be provided from each source and is to be completely labeled identifying the source and specifications and characteristics.
   3. The Contractor shall obtain from the site or nursery and submit to Landscape Architect a certificate stating that the provided materials conform to the contract requirements.

C. Gravel Mulch Samples:
   1. Samples shall be submitted to the Landscape Architect for approval, prior to its use in the project. Mulch samples shall be tested for pH, which must be between 4 and 6.
   2. A minimum 50-pound bag is to be provided from each source and is to be completely labeled identifying the source and specifications and characteristics.

D. Qualification Data: For qualified landscape installer.

E. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis for standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

F. Planting Schedule: Indicating anticipated planting dates for exterior plants.

G. Warranty: Sample of special warranty.

H. Service Contract: submit a plant maintenance service contract to cover a period of five years initiated after final inspection and acceptance.

1.05 QUALITY ASSURANCE

A. Plant Nomenclature: Conform to the latest edition of "Standardized Plant Names" as adopted by the American Joint Committee of Horticultural Nomenclature Size and Grading Standards: Conform to the current edition of "American Standard for Nursery Stock" – Sponsor – the American Association of Nurserymen Inc., unless otherwise specified.

B. Planting and Care Standards: Conform to the current edition of "The American National Standard for Tree Care Operations" ANSI A300 . Sponsor – International Society of Arboriculture, unless otherwise specified.

C. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.
   1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
   1. Selection of exterior plants purchased under allowances will be made by Landscape Architect, who will tag plants at their place of growth before they are prepared for transplanting.

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Landscape Architect may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
   1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

G. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver plants freshly dug.

B. Do not prune trees and shrubs before delivery except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.
   1. Do not remove container-grown stock from containers before time of planting.
   2. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.07 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
   1. Spring Planting: March 15 to June 15.
   2. Fall Planting: September 15 to November 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed according to manufacturer's written instructions and warranty requirements.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Landscape Architect.
   1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.08 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
      b. Structural failures including plantings falling, leaning or blowing over.
      c. Faulty operation of tree stabilization.
   2. Failures include, but are not limited to, the following:
      a. Trees and Shrubs: Two years.
      b. Ground Cover and Plants: Two years.
   3. Failures include, but are not limited to, the following:
      a. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
      b. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
      c. A limit of one replacement of each exterior plant will be required except for losses or replacements due to failure to comply with requirements.
      d. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

1.09 PERFORMANCE

A. The Contractor shall maintain a minimum 100% survival of trees and shrubs for 5 years after final inspection and acceptance. This shall include care and replacement to achieve the required coverage.

PART 2-PRODUCTS

2.01 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with current issue of the American Standard for Nursery Stock published by the American Association of Nurserymen, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Provide trees and shrubs of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Label each tree and shrub with securely attached waterproof tag bearing legible designation of botanical and common name.

E. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

F. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.02 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

B. Small Upright Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as per Drawings.

C. Small Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as per Drawings.

2.03 DECIDUOUS SHRUBS

A. Form and Size: Shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

2.04 PLANTS

A. Plants: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

2.05 TOPSOIL

A. Refer to Section 329313 Landscape Soils Preparation for topsoil requirements.

2.06 FERTILIZER

A. Fertilizer is to be applied only to containerized trees and shrubs. The Contractor shall use organic fertilizers in lieu of petroleum based fertilizers. Suitable products that are commercially available are marketed and certified as 'organic' or 'natural' fertilizers. Organic materials shall include such items as: sea grasses/kelp, rock powder, bone meal, whey, bean meal, blood meal, composted manure, etc. Product nutrient content shall be identified in the standard form of Nitrogen (N), Phosphorous (P) and Potassium (K) ratios. Fertilizer nutrient content shall be based on soil nutrient requirements derived from site soil tests. Any proposed substitution to this nutrient content must be approved by Landscape Architect.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.07 ORGANIC MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Shredded hardwood mulch shall consist of natural uncomposted wood and bark from hardwood trees that have been milled to a minimum particle size of 1 inch x ½ inch x ¼ inch and a maximum particle size of 4 inches x 4 inches x 2 inches. Shredded hardwood mulch shall contain no more than 20% hardwood sawdust (less than 600 microns) and negligible amounts of other woody materials.

B. Compost Mulch: Refer to Section 329113 Soil Preparation for acceptable compost.

2.08 TREE STABILIZATION MATERIALS

A. Stakes and Guys:
   1. Upright and Guy Stakes: Cedarwood stake free of knots, holes, cross grain, and other defects, 3" round by length indicated, pointed at one end.
   2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes. Acceptable products include Arborguard+ ProLock or approved equivalent.

2.09 TEMPORARY PLANT PRIOTECTION FENCING

A. Temporary Fencing: Provide black, 6-foot steel 'T'-posts at maximum 6 foot on center spacing. Provide 54" minimum height black sure-fit sleeve clips to cover posts and accept nylon braided rope.
   1. T-Sleeve Covers- polypropylene with UV protectant.(https://www.homedepot.com/p/Sure-Fit-54-in-Black-T-Post-Sleeve-with-cap-25-Pack-385434/205345726) or approved equal.
   2. ¼" Nylon braided rope; color black.
   3. Contractor to provide means of secure attachment of fence to T-sleeve covers where necessary. Contractor shall be responsible for maintaining erect fencing throughout the duration of the Project and as directed by Owner.

2.10 TRUNK PROTECTION

A. Trunk Protection: Durable, open-mesh plastic guard intended to protect deciduous tree trunks from damage by animals, to be placed on all new trees.
   1. Size: 4" diameter x 48" length.

PART 3-EXECUTION

3.01 PLANTINGS

A. All areas disturbed by construction shall be planted in accordance with the composition and planting schedules per the landscape plans.

B. The Contractor shall refer to the Plant Schedules and Details on the Design Drawings for specific spacing requirements.

C. In order to achieve proper spacing and distribution, it is suggested that the Contractor first lay out all random spaced plant material, beginning in the center of an area/zone and continuing in a radial direction. Then the Contractor shall lay out any cluster spaced plant material amongst the random spaced plant material, again working in a radial direction beginning from the center of the area/zone.

D. Immediately after site preparation and approval, trees and shrubs shall be planted. Planting shall be conducted between September 15 and November 15 or as directed by Landscape Architect. Trees and shrubs shall not be planted when the ground is frozen.

E. Root stock of the plant material shall be kept moist during transport, from the source, to the job site and until planted.

F. The Contractor may be required to flag and label individual planting pits at specific locations. Before planting a typical area within each planting zone, the Contractor shall have Landscape Architect inspect and approve plant spacing and planting techniques before proceeding. The plant spacing within the typical area and/or spacing recommendations from Landscape Architect will then help guide any necessary plant spacing adjustments required for the remainder of the planting zone.

3.02 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.04 PLANTING BED ESTABLISHMENT

A. Spread planting soil mix to a depth as indicated on Landscape Soils Plan but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Before planting, restore planting beds if eroded or otherwise disturbed after finish grading.

3.05 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
   1. Excavate approximately three times as wide as ball diameter for all stock.
   2. Walls of planting pits shall be dug so that they are vertical or sloping outward in heavy soils. Scarify the walls of the pit after digging.
   3. The planting pit shall be only as deep as is required to establish the trunk taper/root flare line at approximately 1 inch above finish grade.
   4. Remove all non-organic debris from the pit and tamp loose soil in the bottom of the pit by hand.

B. Subsoil removed from excavations for tree and shrub planting may not be used as backfill for plant installation.

C. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

D. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.06 TREE AND SHRUB PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Set container-grown stock plumb and in center of pit or trench with top of root ball 1 inch (25 mm) above adjacent finish grades.
   1. Carefully remove root ball from container without damaging root ball or plant.
   2. Do not handle the plant by the branches, leaves, trunk or stem.

C. Place the plant straight in the center of the planting pit, carrying the plant by the root mass. Never lift or carry a plant by the trunk or branches.

D. Prior to backfilling the pit, place 5 ounces of fertilizer in each plant pit for up to 2-gallon size containers and 15 ounces for 15-gallon container. Place the fertilizer in the planting pit completely surrounding the root ball.

E. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

F. Organic Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within 3 inches (75 mm) of trunks or stems.

G. Inspect tree trunks for injury, improper pruning, and insect infestation; take corrective measures required before wrapping.

H. Wrap tree trunks with plastic tree protection mesh.

I. Remove all tags, labels, strings and wire from the plant materials, unless otherwise indicated in the details.

J. The Contractor shall leave no open planting pits at the close of each day.

3.07 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

3.08 TREE STABILIZATION

A. Trunk Stabilization: Unless otherwise indicated, provide trunk stabilization as follows:
   1. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1830 mm) above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
   2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.09 PLANTING

A. Set out and space plants as indicated.

B. Dig holes large enough to allow spreading of roots and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 PLANTING BED MULCHES

A. Mulch backfilled surfaces of planting beds and other areas indicated. Provide mulch ring around trees in lawn areas.
   1. Organic Mulch: Apply 3-inch average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.11 EDGING INSTALLATION

A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.

3.12 PLANT MAINTENANCE

A. Tree, Shrub, and Plant Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting and repairing stakes and guy supports and root-ball stabilization, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

B. Provide full maintenance by skilled employees of landscape installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than the maintenance periods below.
   1. Maintenance Period: Six months from date of Initial Acceptance.
   2. When full maintenance period has not elapsed before end of planting season, or if planting is not fully established at the time, continue maintenance during next planting season.
   3. Existing plants and lawns to remain within Project Limits: Maintain throughout the time of construction through the conclusion of the Maintenance period.

3.13 WATERING

A. Contractor shall water plants at a minimum rate of 2 inches of water per week during the growing season. It will be the Contractor's responsibility to supply water if there is none available on Site. Any costs associated with supplying water shall be the responsibility of the Contractor.

3.14 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.15 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Section required under Division 1, the General Requirements, are included as a part of this section as though bound herein.

1.02 SUMMARY

A. Section includes:
   1. Mixing and placement of imported soils.
   2. Soil schedule.
   3. Turf soil mix.
   4. Planting soil mix.
   5. Structural soil subbase material for areas adjacent to tree plantings.

B. Related work as specified elsewhere:
   1. Division 31 Section “Earth Moving” for excavation, filling, rough grading, backfill, clean fill and stone materials.
   2. Division 32 Section “Turf and Grasses” for turf soil mix placement.
   3. Division 32 Section “Plants” for planting soil mix placement.

1.03 REFERENCES

A. ANSI: American National Standards Institute.

B. AOAC: Association of Official Agricultural Chemists.

C. ASA: American Society of Agronomy.

D. ASTM: American Society for Testing Materials.

E. USDA Soil Texture System of Classification.

F. Comprehensive Assessment of Soil Health: The Cornell Framework Manual, Third Edition.

1.04 DEFINITIONS

A. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, and compost.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation.

C. Compacted soil: soil where the density of the soil is greater that the threshold for root growth.

D. Compost: well decomposed stable organic material as defined by the US Composting Council.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Planting Soil: imported topsoil mixed with soil amendments for planting trees, shrubs, ground covers and lawn.

G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.

H. Subsoil: All soil beneath the topsoil layer of the site soil profile, and typified by the lack of organic matter and soil organisms. Subsoil is unsuitable for plant growth unless amended as specified.

I. Topsoil: Natural or cultivated soil containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

1.05 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated.

C. Notify utility locator service for area where Project is located before site clearing.

D. Except for materials indicated to be stockpiled, reinstalled or to remain Owner’s property, cleared materials shall become Contractor’s property and shall be removed from the site.

1.06 SUBMITTALS

A. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
   1. Landscape Architect shall reserve the right to reject any soil supplier.
   2. Soil mix supplier shall have a minimum of five years’ experience at supplying custom planting soil mixes.

3. Submit supplier name, address, telephone and fax numbers, and contact name.
4. Submit certification that the accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

B. Samples: Prior to installing soil mixes, submit representative samples to Landscape Architect for approval. Do not place any soil mixes until Landscape Architect's approval has been obtained. Samples will be reviewed for appearance only.
1. Imported loam soil mix.

C. Compost.
1. Product Data: For each type of product indicated, including source.
2. Certificates: Provide certificates required by authorities having jurisdiction, especially for any composted materials containing sewage sludge. Approval as EPA Type 1 "exceptional quality" is required as well as that of the State of New York.

D. Testing: As described in Quality Control. All Other Amendments: Product Data.

E. Imported Planting Soil Mixes: The following testing is required of all soil mixes comprised of imported soil materials:
1. Submit soil test analysis report from an approved soil-testing laboratory to show physical, biological and chemical soil conditions (Cornell Soil Health Test or equivalent):
a. USDA Soil Texture Classification.
b. USDA gradation (percentage) of gravel, sand, silt and clay. Aggregate stability test.
c. Soil pH.
d. Organic Matter: Percent organic matter by combustion (ASTM F-1647, Method 1).
e. Nutrient levels by parts per million including: phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.
f. Soluble Salts.
g. Heavy Metal Screening.
h. Overall Quality Score: Greater than or equal to 70, high quality soil.
2. If initial testing does not result in a planting soil mix meeting the quality score of 70 or greater, the Contractor shall be responsible for amending planting mix and retesting until target score is achieved.

1.07 QUALITY ASSURANCE

A. Source Limitations for Topsoil and Planting Soil Mix: Obtain all topsoil and/or planting soil mix through one source that has been tested according to the requirements below. If there are any additional proposed sources, Contractor must provide topsoil analysis and testing for each source as described below.

B. Sources for Soil Components and Planting Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.
1. Landscape Architect shall have the right to reject any soil supplier.
2. Soil mix supplier shall have a minimum of five years' experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone numbers and contact name.

C. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project.

D. Soil-Testing Laboratory Qualifications: Proposed planting mix shall be tested by the following, or equivalent.
1. Cornell Nutrient Analysis Lab
c/o Soil Health Lab
G01 Bradfield Hall
306 Tower Rd.
Ithaca, NY 14853
soilhealth@cornell.edu
http://soilhealth.cals.cornell.edu
(607) 227-6055

E. Infiltration Testing: After placement of planting soils, test soil bed for infiltration rate according to ASTM D3385-18.

1.08 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
1. This specification requires that all Planting Soil work be completed and accepted prior to the installation of any plants.

1.09 SOIL COMPACTION – GENERAL REQUIREMENTS

A. Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.

B. The following are threshold levels of compaction as determined by each method.
1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.

a. Penetration Resistance Method – about 75-200 psi, below 75 psi soil becomes increasingly unstable and will settle excessively.

2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.
   a. Penetration Resistance Method – about 200-300 psi.
3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.
   a. Penetration Resistance Method – Approximately above 300 psi.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Material should not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall or is frozen. Soil should be handled only when the moisture content is less than at field capacity. The Landscape Architect shall be consulted to determine if the soil is too wet to handle.

B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.

C. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.

D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.

E. Soil that is to be stockpiled longer than two weeks, whether on or off site, shall be placed in mounds less than six feet high. If soil stockpiles greater than six feet high are present longer than two weeks then the contractor shall break down and disperse soil so that mounds do not exceed the six foot height restriction for longer than two weeks.
   1. Provide silt fencing around topsoil mounds, and/or as directed in the Storm Water Pollution Prevention Plan (SWPPP).

F. Vehicular access to the site is restricted. The Contractor shall include proposed routing for deliveries and site access in the Soil Management Plan.

G. Soil materials shall not be handled or hauled, placed or compacted when it is wet, as after a heavy rain, nor when frozen. Soil shall be handled only when the moisture content is less than field capacity.

PART 2-PRODUCTS

2.01 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; clean and free of deleterious materials and weeds, including but not limited to any plant listed by NYSDEC or other authority as invasive, nuisance or noxious weed species; and free of extraneous materials harmful to plant growth.
   1. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.
      a. Gernatt Gravel, (716)532-3371
   2. Topsoil used for turf soil and planting soil mixes must be free of stones 1 inch (25 mm) or larger in any dimension.
   3. Unscreened topsoil meeting the above requirements may be utilized.
   4. Imported Topsoil shall meet the following physical and chemical criteria:
      a. Soil texture: USDA loam, sandy clay loam or sandy loam with clay content between 15 and 25%. and a combined clay/silt content of no more than 55%.
      b. pH value shall be between 5.5 and 7.0.
      c. Percent organic matter (OM): 3.0-5.0%, by dry weight.
      d. Soluble salt level: Less than 1.5 mmho/cm.
      e. Soil chemistry suitable for growing the plants specified.

2.02 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight.
   1. Organic Matter Content: 40 percent of dry weight minimum. One hundred percent of the material shall pass a 1.0-inch screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. (ASTM F-1647, Method 1).
   2. The ratio of carbon to nitrogen shall be in the range of 10:1 to 25:1.
   3. One hundred percent of the material shall pass a 3/8-inch (or smaller) screen. (ASTM D-422-63).
   4. pH: The pH shall be between 5.5 to 8.0 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter. (American Society of Agronomy Methods of Soil Analysis, Part 2, 1986).
   5. Salinity: Electrical conductivity of a one to two soil to water ratio extract shall not exceed 4.0 mmhos/cm (dS/m).

6. Heavy metal contents shall conform to state and federal regulations.
7. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32.
8. Nutrient content shall be determined by the Cornell University Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.
9. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Compost may be obtained at one of the following sources, provided that the test requirements are met:
1. WeCare Compost by We Care Organics, Jordan, New York, 315-689-1937
2. Cayuga Compost (fine) by P&S Excavating, Trumansburg, New York, 607-387-6826
3. Cornell Farm Services, Ithaca, NY: 607-257-2235
4. CJ Krantz Organics, Clarence Center, NY, 716-741-3850
5. Fessenden Farms, King Ferry, NY, 877-767-7280
6. Approved equivalent.

2.03 SAND FOR SOIL MIXES

A. Sand: Clean AASHTO M-6 or ASTM C-33 concrete sand.

U.S. Sieve Size No.	% Passing Minimum	% Passing Maximum
¾ in	100	
4	95	100
8	80	100
16	50	85
30	25	60

1. Sand substitutions such as Diabase and Graystone #10 are not acceptable. No calcium carbonated or dolomitic sand substitutions are acceptable. “Rock dust” cannot be substituted for sand.
2. pH shall be lower than 7.0

2.04 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition.
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition.
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.05 SOIL MIXES, GENERAL

A. All mixes shall meet the following criteria.
1. Free of stones 1”, stumps, roots and other woody material over 2” in diameter.
2. Free of brush and seeds from noxious weeds.
3. pH 5.5 to 7.5
4. Soluble salts <500 ppm.

2.06 TURF AND SEEDING SOIL MIX

A. Turf soil shall be a loamy sand as defined by USDA Soil Texture System of Classification created from combination of accepted sand, topsoil, and compost meeting the following criteria:
1. By volume:
   a. Clay 0% to 20%
   b. Silt 0% to 30%
   c. Sand 70% to 80
2. % passing #270 sieve 11-14%
3. Uniformity ratio of sand D70/D20 <4.5
4. Permeability >4” inch per hour
5. pH 5.5 to 7.5

6. Organic Matter 4-5%
7. Compaction: 86-88% max

B. Cornell Soil Health Assessment Overall Quality Score of 70 or above, with all sub-indicator test ratings scoring 30 or above.

2.07 PLANTING SOIL MIX

A. Planting soil mix shall be a loam as defined by USDA Soil Texture System of Classification created from combination of accepted sand, topsoil, and compost meeting the following criteria:
1. By volume:
   a. Clay 10% to 25%
   b. Silt 30% to 50%
   c. Sand 25% to 50%
2. % passing #270 sieve 11-16%
3. Uniformity ratio of sand D70/D20 <6.0
4. Permeability >3" inch per hour
5. pH 5.5 to 7.5
6. Organic Matter 6-9

B. Cornell Soil Health Assessment Overall Quality Score of 70 or above, with all sub-indicator test ratings scoring 30 or above.

2.08 STRUCTURAL SOIL

A. A mixture of crushed stone, clay loam, hydrogel and amendments meeting the requirements of "CU Structural Soil®" patented by Cornell University (Patent #5,849,069) also known as "CU Soil TM". Material shall meet the requirements of NYSDOT Item 610.14000011 Structural Soil Mix.
1. The material shall be obtained from a Producer sublicensed by Amereq, the exclusive Licensee of Cornell University for CU-Structural Soil®. Proof of such sub-licensing shall be submitted to the Engineer along with a sample of the finished mix, prior to delivery to the site. For a list of licensed CU Soil™ producers, call AMEREQ, Inc. @ 1-800-832-8788.

2.09 SOIL SCHEDULE

A. Refer to the following table and the Drawings for locations.

Soil Mix/Type	Use/Location
Turf soil mix	Lawn and Seeding areas
Planting soil mix	All planting beds, pollinator planting areas and tree pits

PART 3-EXECUTION

3.01 EXAMINATION

A. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil mix until all work in adjacent areas is complete and approved by the Landscape Architect.

B. Examination of Subgrade: The subgrade shall be inspected prior to the start of soil placement for conformance with the Drawings for elevations of subgrade relative to finish grade. Subgrade shall be graded to pitch toward underdrains unless otherwise noted in the Drawings.

C. Pre-Grading Inspection: Prior to the commencement of Work, contact the Landscape Architect to provide an inspection to verify the delineation areas on the Soils Plan and proposed location(s) for topsoil and material stockpiling. Make corrections and adjustments as directed by the Landscape Architect prior to commencing any work.

3.02 MIXING OF SOIL MIXES

A. General Soil Mix Preparation: Examine soil and remove foreign materials, stones over 1/2", and organic debris over 2" in length. All preparation and mixing shall be accomplished when the soil moisture content is less than field capacity.

B. Adequate quantities of mixed planting soil materials shall be provided to attain, after compaction and natural settlement, all design finish grades.
1. Minimum depths of mixed soils must be achieved per planting details. Contractor shall remove excess soils from site as needed at no additional cost.

C. Soil mixes shall be produced with equipment that blends together each component in a thorough and uniform manner.
1. Soil mixing can occur in-place or off-site.

3.03 SOIL PREPARATION TECHNIQUES

A. Import topsoil and amend to achieve a sandy loam as defined by the USDA Soil Texture System of Classification.
   1. Applicability: All areas designated for lawns and planting beds that need additional material to achieve finish grades.
   2. Contractor shall manufacture soil mixes as follows:
      a. Contractor shall procure all soil component materials.
      b. Mix in fertilizers and amendments as needed to achieve Overall Soil Quality Score of 70 or more.

3.04 SOIL PLACEMENT

A. Placement: Scarify or till subgrade to depth needed to achieve required depth of planting or turf soil mix after amending. Entire surface shall be disturbed by scarification. Do not scarify within drip line of existing trees.
   1. Scarification does not apply in locations where planting beds occur over liner.

B. Rake beds to fine grade and remove surface rocks larger than 2 inches in diameter.
   1. In turf areas, roll to compact soil to 86% to 88% of maximum density and remove rocks and debris greater than 1 inch in diameter.
   2. In planting areas, roll to compact soil to 82% to 86% of maximum density and remove rocks and debris greater than 1 inch in diameter.

3.05 COORDINATION AND EXCESS MATERIALS

A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to soil placement.

B. Excess Soil Materials: Remove the excess soil materials from the site at no additional cost to the Owner unless otherwise requested. If these materials come in contact with existing site soils from below the existing clay cap, they are required to be disposed of per the Soil's Management Plan (see Technical Appendix).
   1. Director's Representative shall reserve right of first refusal on all amended soil mixes.

3.06 FIELD QUALITY CONTROL

A. Post-Installation Inspection: Prior to planting, contact the Landscape Architect to provide an inspection verify that the placement of amendments and soil preparation is consistent with the Soil Management Plan.
   1. Contractor and Landscape Architect shall verify depth and compaction level of imported planting soil placement and/or tilled and amended soil depth prior to installation of plants.
   2. If required depth is not achieved, Contractor shall provide additional rototilling, mixing and compost to achieve specified depth at no cost to the Owner.

B. Provide delivery tickets for soil amendments to verify the quantity of material specified on the Soil Management Plan. Make corrections and adjustments as directed by the Landscape Architect.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplemental conditions and Division 33 specifications apply to this section.

B. Related Work Specified Elsewhere: Site Clearing, Section 31 1000; Earthmoving, Section 31 2000; Dewatering, Section 31 2319; and Excavation Support and Protection, Section 31 5000; Water Utility Distribution Valves, 33 1216.

1.2 SUMMARY

A. This section specifies the labor, materials and installation for construction of water systems. The water system shall include, but not be limited to, the pipe and fittings for site domestic and fire water lines, valves, fire hydrants, and related appurtenances.

1.3 SUBMITTALS

A. General: Submittals shall be made according to the conditions of the Contract and Division 1 Specifications Sections.

B. All manufacturers' literature and product information for pipe materials, pipe fittings, hydrants, valves accessories, and water main disinfectant.

C. Submit product quality assurance data and laboratory test data for all materials, and manufacturer's certificate that the proposed materials comply with all project specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe (All Water Mains and Fire Services)

1. Ductile iron water pipe shall be in accordance with ANSI/AWWA C151 with standard asphaltic exterior coating, cement lined in accordance with ANSI/AWWA C104, push-on elastomeric joint type conforming to ANSI/AWWA C111, (Wall Thickness Class 52). Fittings shall be gray or ductile iron, cement lined, mechanical joint complying with ANSI/AWWA C111 requirements.
   a. Anchor pipe as manufactured by American Pipe Products, U.S. Pipe, or approved equal.
   b. Anchor Tees shall be Ductile Iron or Gray Iron fittings, 3-inch through 48-inch for water and other liquids in accordance with ANSI/AWWA C110. They shall be as manufactured by Clow, American Ductile Iron Pipe, or approved equal.
   c. Straight and Transition Couplings shall have rubber gasket joints for ductile iron in accordance with ANSI/AWWA C111 and comply with ASTM A536, Standard Specification for Ductile Iron Castings. Couplings shall be as manufactured by Smith Blair, Dresser, Ford, or approved equal.
   d. Fittings shall be in accordance with ANSI/AWWA C110 (full body) or ANSI/AWWA C153 (compact) for ductile iron and pressure rated for the same internal pressure rating of the specified pipe. Joints shall be in accordance with ANSI/AWWA C111, rubber gasket, mechanical joint.
   e. Fasteners: All T-bolts, bolts, studs, nuts, and lugs below grade shall be 316 stainless steel or fluorocarbon coated and coated with bitumastic; All fasteners for couplings shall be 316 stainless steel or fluorocarbon coated and coated with bitumastic. Zinc caps shall be 6-ounce minimum and installed on three bolts per below grade mechanical joint (6 total per fitting/valve).
   f. Bitumastic coating shall conform to AWWA C203-02 and shall be as manufactured by Roscote R28 by Royston, Koppers 300M, Tnemec 46h-413, or approved equal.
   g. Polyethylene encasement shall be provided for all ductile iron pipes, unless the CONTRACTOR provides for soil testing and observations as specified below, at no additional cost to the OWNER, proving the encasement is not needed.
      1) Soil testing and observations shall evaluate the following factors to determine the corrosion potential of the ductile iron pipe in the soil.
         i. Earth Resistivity
         ii. pH
         iii. Oxidation-reduction (redox) potential
         iv. Sulfides
         v. Moisture Content
         vi. Soil description
         vii. Potential stray direct current
         viii. Experience with existing installations with the area

         Testing shall be performed at maximum intervals of 100-feet unless otherwise directed by the OWNER. The evaluation and weighted sum of each factor shall be in accordance with Appendix A for ANSI/AWWA C105. The determination of the need for polyethylene encasement for ductile iron pipe shall be based on the soil testing score.

2) Polyethylene encasement shall conform to ANSI/AWWA C105, have a thickness of 8 mils. The pigmentation shall be natural when exposed to ultraviolet light for less than 48-hours. When exposed to ultraviolet light for 2 to 10-days pigmentation shall be 2.0 to 2.5%, well-dispersed carbon black with stabilizers. Encasement shall be as manufactured by Dupont Athalon, USI Petrothene resins, or approved equal.

3) Installation of the encasement shall consist of cutting the polyethylene tubing in lengths that are 2-feet longer that the pipe section and placing around the pipe. After pipe joint has been made, overlap joint with polyethylene tube and secure with closure tape. Fold tube over at top and secure at quarter points along the pipe section. Remove and replace all damaged tube at no additional cost to the OWNER.

B. Hydrants

1. Hydrants shall be AWWA C502, UL 246, dry barrel type for freezing conditions. They shall be 5 ½-foot bury with a 5 ¼-inch valve opening and be equipped with a standard pentagon operating nut, 1 ½-inch point to flat. Hydrants shall open counterclockwise and the minimum net water area of the barrel shall not be less than 190 percent of the barrel length. Inlet connections shall be 6-inch bell or mechanical joint with accessories, gland bolts, and gaskets.
2. Hydrant extensions shall be manufactured in 6-inch multiples, with rod and coupling to increase barrel length.
3. Hose sizes shall be to match utility company (national standard threads), and include two 2 ½-in. hose nozzles, one 4 ½-in. pumper nozzle. Pumper nozzle shall face the street.
4. Hydrants shall be finished with primer and two coats of red enamel as shown on the Contract Drawings and as approved by the Owner.

C. Service Connections (For Potable Water Services)

1. Service material shall be seamless Type K copper supplied in conformance with ASTM B88.
2. Service saddles shall conform to ANSI/AWWA C800 and shall be Double Strap Bronze Saddle Clamp manufactured by Mueller, or approved equal.
3. Curb stop and box shall conform to ANSI/AWWA C800, Brass Curb Stop and Corporation by Mueller, or equal.
4. Corporations shall be fabricated from metal alloy red brass 85-5-5-5 in accordance with the chemical and mechanical requirements of ASTM B62. Corporations shall be ball valve, cylinder, plug valve, or ground key valve construction. Inlet threads shall conform to AWWA C-C and have compression outlets. Manufacturers include Cambridge Series 2000, Mueller #110 Series, or approved equal.
5. Curb stops shall be fabricated from metal alloy red brass 85-5-5 in accordance with the chemical and mechanical requirements of ASTM B62. Curb stops shall be ball valve or ground key valve construction. Connections shall be compression or iron pipe as required. Manufacturers include AY McDonald Series #6100-B-22, Ford Series B-41, or approved equal.
6. Curb boxes shall be 1-1/4 inch arch pattern extension type with 5 ½-foot bury, 66- inch maximum extended length and compressed minimum length of 54-inches. Bottom section arch must fit ¾-inch and 1-inch ball valve stop. Lids shall have a brass pentagon head plug and have the word "WATER" cast in raised letters. Manufacturers include AY McDonald #5604, Ford #EA-2, or approved equal.
7. Tapping saddles shall be metal alloy red brass 85-5-5 in accordance with chemical and mechanical requirements of ASTM B-62 and AWWA C800. Strap nuts fabricated of the same brass alloy, with straps made of flattened silicone bronze. Outlets shall conform to AWWA Standard CC female thread and gaskets shall be BUNAN-N rubber, as per ASTM-D2000 8-0M5 BG506.
8. Brass service couplings shall be fabricated from metal alloy red brass 85-5-5 in accordance with the chemical and mechanical requirements for ASTM B62, with compression inlet and outlet.

D. Blow-Offs

1. Blow-offs, if required, shall be located as shown on the Contract Drawings.
2. Blow-off material shall consist of 1-in. or 2-in. brass pipe as shown on the Contract Drawings, with standard pipe threads and standard brass fittings.
3. Blow-off risers shall consist of hot dipped galvanized or copper pipe.

E. Thrust Blocks And Concrete Spacers

1. Thrust blocks shall be as specified on the Contract Drawings and constructed with Portland Cement Concrete, Class A, conforming to NYSDOT Standard Specification Section 555 and Section 501.
2. Framework shall be Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances, coated with a release agent that will not adversely affect the concrete or interfere with application of coatings. Pre-cast concrete spacer and support blocks shall be as specified on the Contract Drawings.

F. Plugs

1. Plugs shall be ductile iron and shall conform to the requirements of ANSI\AWWA C110.

G. Extension Stems

1. Valves installed in the ground with the opening nut greater than 4-feet below grade shall have extension stems that extend to within three feet of the finished grade.

2. A centering device shall be installed in the extension stem just below the operating nut.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify the type and outside diameter of existing mains at connection location prior to ordering any tapping materials.

B. Examine all pipe and appurtenances for defects, etc. prior to installation.

C. Clean interior of all pipe and appurtenances and remove all foreign substances prior to installation.

D. Examine trench for rock and unstable conditions. Apply bedding as required per the Contract Drawings and Section 31 2333, Trenching and Backfill.

E. Excavate bell holes at each joint to permit the joint to be made properly and to provide uniform and continuous bearing for the pipe.

3.2 INSTALLATION

A. Pipe

1. Install pipe at the locations and grades shown on the Contract Drawings.
2. Install piping and fittings in accordance with ANSI/AWWA C600 requirements.
3. Route pipe without exceeding maximum allowable joint deflections.
4. Form and place trust blocks at each elbow or change of direction of the pipe main.
5. Install temporary blow-off and sampling taps to permit flushing, disinfection and testing of installed system.

B. Hydrants And Accesories

1. When installing hydrants, if groundwater is encountered, as verified by the Project Representative, within seven (7)-feet of finish grade, weep holes (drains) shall be plugged.
2. Install gate valves and hydrants as indicated on the Contract Drawings.
3. Install all gate valves and hydrants in a vertical and plumb position. Backfill carefully to maintain a vertical and plumb positioning.
4. Install valve boxes in a manner that will not transmit loads, stress or shock to the valve body. Center valve box over operating nut and securely fit valve box together leaving cover flush with the finished grade surface.

C. Connections To Existing Mains

1. Connections to existing water mains shall be made in a manner approved by the Owner and include dry and wet taps, as selected by the Contractor. The Contractor shall furnish and install the tap, valve, and all necessary appurtenances as required to make the connection to the existing water line
2. All parts of the tapping equipment that will be in contact with the water in the main shall be washed in a chlorine solution before using.
3. Equipment for pressure taps shall be valved and gasketed to prevent leakage during the tapping.

D. Plugs

1. Plugs shall be installed in accordance with the manufacturer's recommended procedures and requirements.

E. E. Use Of Fire Hydrants During Construction

1. If fire hydrants are used during construction as a source of water, a temporary backflow prevention device shall be installed.
2. Backflow prevention device for hydrants shall be manufactured by Watts, Ames, or approved equivalent.
3. The contractor shall coordinate the location of the hydrant to be used as a water source with the Owner or designated representative.

3.3 DISINFECTION

A. (See section 33 13 00)

3.4 TESTING

A. All pipe work shall be tested up to the curb stops at a minimum of 150-psi for a period of 2 hours. Test pressures shall not vary by more than 5-psi (+/-) throughout the duration of the test. The maximum amount of leakage per 1,000 linear feet of 8-inch diameter pipe shall be 0.74 gallons per hour.

B. All pressure and leak testing shall be in conformance with AWWA Specifications C600 for mechanical and push-on joint point.

C. Locate and repair all leaks and repeat test as necessary until test results are satisfactory and comply with the appropriate standards.

D. Furnish copies of all testing upon completion of water distribution system backfilling.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplemental conditions and Division 33 specifications apply to this section.

B. Related Work Specified Elsewhere:
   1. Earthmoving, Section 31 20 00;
   2. Dewatering, Section 31 23 19;
   3. Excavation Support and Protection, Section 31 50 00;
   4. Storm Drainage Manholes, Frames and Covers, Section 33 49 13; and
   5. Bases, Ballasts and Pavements, Section 32 10 00.

1.2 SUMMARY

A. This section specifies the materials, construction, and testing requirements for all storm water sewer pipes, laterals, stormwater culverts, end sections, and other related sewer structures, as shown on the Contract Drawings and as specified herein.

B. The Contractor shall furnish and install the pipes, pipe bedding, and other incidental work as shown on the contract plans and as required to complete the project. All work under this section shall comply with the Owner's standards.

1.3 SUBMITTALS

A. All submittals shall be in conformance to the requirements of the Contract and Division 1 of the Specifications.

B. Submit product data, manufacturer's catalog cuts, specifications and installation instructions.

C. Submit product quality assurance data and laboratory test data for all materials, and manufacturers' certificate that the proposed materials comply with all project specifications.

D. Submit Shop Drawings identifying the fabrication details and connections to adjacent work.

PART 2 - PRODUCTS

2.1 STORMWATER AND CULVERT PIPING

A. HDPE stormwater sewer and culvert piping shall be as required to meet the requirements of NYSDOT Specification §706-12 Smooth Interior Corrugated Polyethylene Pipe and conform to AASHTO M-294 (12 to 36-inch diameter), unless specified otherwise on the Contract Drawings.

B. Plastic Pipe (4 and 6 inches Diameter, Solid and Perforated) for Building Drains, Cleanout Pipes, Discharge Lines, Leaching Fields, Drain Tiles, etc: PVC meeting ASTM D 2241 or SR (Styrene Rubber) meeting ASTM D 2852.

C. Solvent cements used for joining plastic pipe and fittings shall meet ASTM designation D 2564.

D. All material specified in this section shall be new, unused, and free from defects. All pipe and fittings shall have the brand name, size, AASTHO Type or rating, ASTM criteria and other appropriate manufacturing information printed on the exterior surface.

E. Acceptable Manufacturer's include:
   1. HDPE: Advanced Drainage Systems, Inc.; 3300 Riverside Dr., Columbus, OH 43221; (614) 457-3051.
   2. HDPE: Hancor, Inc.; 401 Olive St., Findlay, OH 45840; (800) 847-5880.
   3. PVC: Thermal Pipe Systems, Inc.; 5205 W. Woodmill Dr., Wilmington, DE 19808; (302) 999-1588.
   4. Or Approved Equivalent.

F. Pipe-to-Manhole/Drainage Structure Connections - one of the following:
   1. A-Lok Flexible Connector by A-Lok Products, Inc., 697 Main St., Tullytown, PA 19007, (215) 547-3366.
   2. Lockjoint Flexible Connector by Chardon Rubber Company, 373 Washington St., Chardon, OH 44024, (216) 285-2161.
   3. Kor-N-Seal Flexible Connector by NPC, Inc., 250 Elm St., Milford, NH 03055, (601) 673-8680.
   4. Link-Seal Flexible Connector by Thunderline Link-Seal, Inc., 6525 Goforth St., Houston, TX 77021, (713) 747-8819.
   5. Cement mortar in accordance with ASTM C270.

2.2 PIPE BEDDING AND BACKFILL

A. Pipe bedding and backfill shall be as shown on the Contract Drawings and in conformance with the material specifications contained in Section 31 20 00, Earthmoving.

2.3 CULVERT END SECTIONS

A. Culvert end sections shall consist of galvanized Steel End Sections in accordance with NYSDOT Specification §707-10 Galvanized Steel End Sections or aluminum, as approved by the Project Representative.

B. The end section sizes shall be as shown on the Contract Drawings and shall be as required to meet the requirements of NYSDOT Specification §706-12 Smooth Interior Corrugated Polyethylene Pipe.

2.4 INLINE DRAINS

A. Inline drains shall be constructed of materials compatible with the underdrain piping to which they are connected. The inline drains shall be manufactured with properly sized openings so that the connection between the underdrain piping and the inline drain is secure and will prevent the intrusion of soil into the underdrain pipe. The inline drain shall be provided with ductile iron grates that are set flush with the surrounding grade.

B. Inline drains shall be installed in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXCAVATION

A. All excavation shall be to the lines and grades shown on the Contract Drawings.

B. Any suitable excavation methods may be used but sewer trenches shall be confined to the smallest area practical for proper construction and inspection. Hand methods shall be employed where it is deemed necessary by the Owner's Representative. Where necessary, sheeting and/or bracing shall be used to provide support and stability to trench walls. Sheeting and bracing, if required, shall be designed and installed in accordance with Section 31 50 00, Excavation Support and Protection.

C. If blasting is required for removal of boulders or bedrock, all necessary precautions shall be taken to confine flying stone or debris and to protect and prevent damage to adjacent structures.

D. All open excavations shall be completely surrounded with barricades and illuminated at night.

3.2 INSTALLATION

A. All sewers, sewer laterals and related structures shall be constructed to the lines and grades shown on the Contract Drawings and in accordance with the procedures shown on the Contract Drawings and installation methods described in the NYSDOT Standard Specifications for the specified materials.

B. Pipe bedding and backfill shall be placed in accordance with the procedures and at the locations shown on the Contract Drawings and in conformance with the material specifications contained in Section 31 23 33, Trenching and Backfilling.

C. All pipes and fittings shall be handled carefully. Pipes and fittings shall not be dumped or dropped while unloading or during placement in the trench.

D. The Contractor shall take all necessary precaution to insure the stability of any stockpile or individual length of pipe that is stored. Pipe stored along a road or sidewalk shall be placed so that it does not create a safety hazard or impair the free flow of traffic.

E. Materials shall be stored neatly and protected against deterioration. Materials which are rejected by the Owner's Representative shall be immediately removed from the site.

F. The interior of each pipe shall be cleaned before adding the next length.

G. The joint surfaces of all pipes and fittings shall be clean, and shall fit together to form a tight joint. When setting pipe the workmanship and tools used shall be such that the quality and strength of the pipe is not impaired.

H. Jointing shall be accomplished in conformance with the manufacturer's recommendations. Lubricant used at the joint shall be water soluble, non-toxic, non-supporting of bacteria growth and have no deteriorating effects on the pipes or gaskets. Sewer pipe shall be laid upgrade with spigots placed in the direction of the flow. The pipes shall be fitted together to form a smooth, even invert. Sewer pipe shall be laid in a straight line with a constant grade between manholes. Each pipe shall be checked for line and grade as it is laid, before the joint is made. Pipes disturbed after having been laid shall be taken up and re-laid.

I. All pipes shall be laid true to line and grade with bells up-stream and shall have a full, firm and even bearing. Boulders or other natural obstructions shall not be considered cause for varying from true line and grade.

J. The pipe shall be set carefully to line and grade using laser type grade control. Laser equipment shall be set up using at least two grade stakes as elevation and alignment references.

K. No pipe shall be laid during adverse weather conditions, as determined by the Owner's Representative. In no case shall pipe be laid in water. In cases where sewers are being installed in wet conditions or below the ground-water table so that installed pipes become submerged overnight, sufficient backfill shall be placed to prevent the pipe from becoming buoyant.

L. The ends of all laterals shall be plugged or capped to hold pressure while testing, and marked with a 2-inch x 4-inch witness stake extending from the pipe to a point 2-feet above the ground. The top of witness stake shall be painted green.

M. A record shall be kept of the location of all laterals and this information shall be shown on the "as-built" plans.

N. Pipe cleanouts and caps shall be placed at the locations shown on the Contract Drawings. Top of the cleanout or cast iron cover shall be installed flush with finished grade.

3.3 PROTECTION OF WORK

A. Care shall be taken at all times to avoid entrance of mud and water into existing sewers. When connecting to an existing manhole, the connection shall be tightly plugged until completion of the work. At that time, the plug shall be removed and the accumulated water and mud pumped out of the manhole under the observation of the Owner's Representative. The cost of any necessary cleaning or flushing of existing facilities caused by failure to comply with this specification or for other reasons shall be at the Contractor's expense.

B. At the end of each working day (or any other time of work stoppage), the upstream end of the pipe shall be tightly plugged to prevent entrance of mud, silt or muddy water.

3.4 CONFLICTING PIPE LINES AND OTHER UTILITIES

A. No existing pipe line, conduit, cable, pole guy wire or other utilities or portion thereof shall be moved without the consent of the agency operating such utility. Any necessary changes in line and grade of the new pipe line shall be made only with the consent of the Owner's Representative.

B. Any section of the sewer that is found defective in material alignment, grade, joints or otherwise, shall be satisfactorily corrected by the Contractor at no additional cost to the Owner.

3.5 FLUSHING AND CLEANING

A. The benches and inverts of manholes and the bottoms of inlets shall have all mortar dropping chipped away to leave a smooth, clean surface.

B. Upon completion of construction and backfilling of the sewer system, the Contractor shall thoroughly flush all pipes with water and clean all structures. The system shall be left free of all stones, sand, silt or mortar projections.

C. All materials flushed from the sewer system shall be intercepted and removed to prevent the materials from entering the existing system.

3.6 TESTING

A. The Contractor shall provide all necessary materials, equipment, and qualified personnel to conduct testing on all installed sewers, manholes, and existing structures modified for connection, as specified in Paragraphs 3.7 and 3.8 below. The Contractor shall give the Owner's Representative at least three (3) working days notice prior to scheduling any testing.

B. Testing shall be in accordance with the specifications herein and Section 33.85 of the "Recommended Standards for Waste Water Facilities", 2004 Edition and subsequent editions.

3.7 TESTING SEWERS

A. Test sections shall be no greater than 300-feet in length.

B. To ensure proper alignment, laser or lamping of all sewers shall be performed.

C. Sewers shall be checked to determine whether any displacement of the pipe has occurred. The test shall be conducted after the final backfill has been in place at least 30-days. No pipe shall exceed a deflection of 5%. If the deflection tests are to be run using a riding ball or mandrel, it shall have a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

D. After the above tests are satisfied, a video tape recording of the sewers shall be created. A copy of the tape shall be submitted to the Owner for its inspection and records.

3.8 REJECTION AND REPAIR

A. Manhole sections shall be subject to rejection on account of failure to conform to any of the specification requirements herein. In addition, manholes or any portion thereof may be rejected due to any of the following items:
   1. Fractures of cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
   2. Defects that indicated imperfect proportioning, mixing and molding.
   3. Surface defects indicating honeycombed or open texture.
   4. Damaged or cracked ends, where such damage would prevent making a satisfactory joint.
   5. Any continuous crack having a surface width of 0.01-inch or more and extending for a length of 12-inches or more.

B. Manhole sections may be repaired if occasional imperfections in manufacturing exist or if accidental damage occurs during handling. Repaired manholes will be accepted if the repair is properly finished, cured, and sound.

C. The Contractor shall make all necessary repairs and retest all repaired sewers and manholes, at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 00 & 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes:
   1. PE pipe and fittings.
   2. Non-pressure transition couplings.
   3. Drains.
   4. Manholes.
   5. Cast-in-place concrete.
   6. Catch basins.
   7. Pipe outlets.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins: Include plans, elevations, sections, details, frames, covers, and grates.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes in accordance with manufacturer's written rigging instructions.

D. Handle catch basins in accordance with manufacturer's written rigging instructions.

1.8 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
   1. Notify Architect and Construction Manager no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 CORRUGATED-PE PIPE AND FITTINGS

A. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.

B. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.

C. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.

D. Corrugated-PE Silt tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.2 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

2. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Ring-Type, Flexible Couplings:
1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.3 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:
1. Description: ASTM C913; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Design Prefabricated Plastic Manholes:
1. Nyloplast structures by ADS or approved equal.
2. Per Construction Plans and Details

D. Manhole Frames and Covers:
1. Description: Ferrous; 24-inch ID by 9-inch riser with 4-inch-minimum width flange and 27-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318, ACI 350, and the following:
1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
      a) Invert Slope: 1 percent through manhole.
   2. Benches: Concrete, sloped to drain into channel.
      a) Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
   1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
   2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

2.5 CATCH BASINS

A. Standard Precast Concrete Catch Basins:
   1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
   4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   5. Joint Sealant: ASTM C990, bitumen or butyl rubber.
   6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
   7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
   8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
   9. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
   1. Joint Sealants: ASTM C990, bitumen or butyl rubber.
   2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
   3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
   4. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
   5. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.
   1. Size: 30 by 30 inches minimum unless otherwise indicated.
   2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

2.6 PIPE OUTLETS

A. Riprap Basins: Broken, irregularly sized and shaped, graded stone in accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control."
   1. Average Size: NSSGA No. R-5, screen opening 5 inches.

B. Filter Stone: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

C. Energy Dissipaters: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Install piping pitched down in direction of flow.
   2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   3. Install piping with 36- inch-minimum cover.
   4. Install PE corrugated sewer piping in accordance with ASTM D2321.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
   2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.5 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 STORMWATER OUTLET INSTALLATION

A. Construct riprap of broken stone, as indicated.

B. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

C. Construct energy dissipaters at outlets, as indicated.

3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete in accordance with ACI 318.

3.8 CONNECTIONS

A. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with

inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

4. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    a) Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
5. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    a) Unshielded flexible couplings for same or minor difference OD pipes.
    b) Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c) Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.9 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8- inch-thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade in accordance with Section 312000 "Earth Moving."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a) Alignment: Less than full diameter of inside of pipe is visible between structures.
    b) Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c) Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d) Infiltration: Water leakage into piping.
    e) Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a) Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b) Option: Test plastic piping in accordance with ASTM F1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION

PART 1 - GENERAL

1.1 REALTED WORK SPECIFIED ELSEWHERE

A. Storm Utility Drainage Piping: Section 334113.

1.2 SUBMITTALS

A. Shop Drawings: Show a schematic plan of the total drainage system including fabrication details.

B. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each item specified.

C. Samples: 6 inch section of trench drain and grate.

D. Contract Closeout Submittals: Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Owner's Representative.

PART 2 - PRODUCTS

2.1 TRENCH DRAIN SYSTEM

A. A modular extra heavy trench drain system Precast from Fiberglass including interlocking modular components; KS100S System as manufactured by ACO Polymer Products, Inc., P.O. Box 245, 12080 Ravenna Road, Chardon, Ohio 44024, (440) 285-7000.

1. Catch Basin: In-line, 612 series short base, with 6-in dia outlet shall be by the same manufacturer of the trench drain.
2. Trench Drain: Precast sloped interlocking sections with recesses for grating lock down devices molded into channel walls.
3. Trench Drain Grate: KS100S grate shall be DIN 19580, Class A, Type 451Q Stainless Steel by the same manufacturer of the trench drain.
4. Accessories: End caps, outlet couplings, locking devices, concrete anchors, and other accessories required for a complete and watertight system shall be by the same manufacturer of the trench drain.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions.

B. Concrete Placement: Protect grates and channel interior during pouring of concrete. Place concrete in a manner that will not dislodge the channels. Concrete shall be at finished level or 1/8" above the top of the channel to ensure efficient drainage and adequate channel edge protection.

C. Finishing and Clean-up: Following final set of concrete, remove grate protection, place grates in final position and engage locking bolts in correct location.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplemental conditions and Division 2 specifications apply to this section.

B. Related work specified elsewhere:
   1. Earthmoving, Section 31 20 00;
   2. Dewatering, Section 31 23 19;
   3. Excavation Support and Protection, Section 31 50 00; and
   4. Bases, Ballasts and Pavements, Section 32 10 00.

1.2 SUMMARY

A. This section specifies the materials and construction requirements for all stormwater manholes, ladders, frames, and covers, as shown on the Contract Drawings and as specified herein.

B. The Contractor shall furnish and install the stormwater system appurtenances, and other incidental work as shown on the contract plans and as required to complete the project.

1.3 SUBMITTALS

A. All submittals shall be made in accordance with the requirements of the Contract and Division 1 of the Specifications.

B. Submit product data, manufacturer's catalog cuts, specifications and installation instructions.

C. Submit product quality assurance data and laboratory test data for all materials, and manufacturers' certificate that the proposed materials comply with all project specifications.

D. Submit Shop Drawings identifying the fabrication details and connections to adjacent work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar shall conform the requirements of NYSDOT §705-22 Portland Cement Mortar for Bonding Grout.

B. Precast Reinforced Concrete Manhole Riser Sections, Catch Basin Riser Sections, Field and Standard Gutter Inlets, and Eccentric Flat Slab Covers shall conform to the requirements of ASTM C478.

C. Joints between Riser Sections shall be tongue and groove with Super 40 Rubber Joint Gaskets that conform to ASTM C443; Bitumastic sealing tape.

D. Manhole bases may be pre-cast or cast in-place.

E. All manholes and catch basins shall be sealed inside completely with 2-coats of heavy duty repellant protective coating made of coal tar. Bitumastic coatings shall be applied at the location of manufacture for all pre-cast components. Field coatings shall be applied as directed by the Owner's Representative to repair damaged coatings.

F. Non-shrink grout shall be in accordance with NYSDOT §701-05 Concrete Grouting Material, or as directed by the Owner's Representative.

G. Pipe-to-Manhole/Drainage Structure Connections - one of the following:
   1. A-Lok Flexible Connector by A-Lok Products, Inc., 697 Main St., Tullytown, PA 19007, (215) 547-3366.
   2. Lockjoint Flexible Connector by Chardon Rubber Company, 373 Washington St., Chardon, OH 44024, (216) 285-2161.
   3. Kor-N-Seal Flexible Connector by NPC, Inc., 250 Elm St., Milford, NH 03055, (601) 673-8680.
   4. Link-Seal Flexible Connector by Thunderline Link-Seal, Inc., 6525 Goforth St., Houston, TX 77021, (713) 747-8819.
   5. Cement mortar in accordance with ASTM C270

H. Cast-in-place concrete for manhole inverts and other system elements shall conform to the requirements of Class A, NYSDOT §501 - Portland Cement Concrete. Concrete shall have a 28-day compressive strength of 4,000 pounds per square inch (psi) or as shown on the Contract Drawings.

I. Bar reinforcement and wire fabric for concrete reinforcement shall conform to the requirements of NYSDOT §709 - Reinforcing Steel. Material sizes and placement requirements shall be as shown on the Contract Drawings.

J. Precast concrete spacers shall conform to the requirements of Class A, NYSDOT §501 - Portland Cement Concrete. Concrete shall have a 28-day compressive strength of 4,000 pounds per square inch (psi) or as shown on the Contract Drawings.

K. Brick shall conform to the requirements of NYSDOT §704-01 Common Brick or NYSDOT §704-02 Concrete Brick.

L. Steps shall be provided in manholes and be capable of withstanding a 300 pound concentrated live load without permanent distortion and with rungs a minimum 10-inches wide designed to prevent feet from slipping off the ends. All manhole rungs and

steps shall conform to the requirements of NYSDOT §725-02.01 - Steps for manholes. Ferrous metal manhole rungs shall consist of Cast Iron Steps in accordance with Neenah R-1982-F or approved equal. Reinforced plastic steps shall conform to Steel reinforced co-polymer polypropylene ASTM 2146-82, Type 2, grade 43758, ASTM C478-85A. Non-corrodible aluminum magnesium ladders with intermediate supports at 5-foot intervals on forged aluminum with drop front design and grooved thread surface may also be used.

M. Manhole frames and covers for stormwater sewers shall consist of cast iron frame and cover, Neenah R-3492 or approved equal. Frames and covers shall be heavy duty, suitable for highway traffic HS-20 wheel loads as shown and specified on Contract Drawings, and shall comply with the requirements of NYSDOT §655 – Frames, grates and covers. All solid covers shall bear the word "Storm", as appropriate.

N. Open grating for standard stormwater inlets shall be in accordance with the requirements of NYSDOT §655 – Frames, grates and covers and as specified on the Contract Drawings. Acceptable manufactures include East Jordan Iron Works V-5622 or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pipe Openings in Pre-cast Concrete Manhole Riser shall be a groove for the pipe penetration seal that shall be installed when the manhole section is cast.

3.2 STORMWATER SEWER MANHOLE INSTALLATION

A. Cast-in-place concrete construction shall be in accordance with the requirements of NYSDOT §555 - Structural Concrete.

B. Build structures to the shapes and dimensions shown with pre-cast reinforced riser sections to the dimensions shown on the Contract Drawings. Seal joints between pre-cast riser sections with material specified. Steps shall be installed 12-inches on center from top to bottom and in a manner capable of withstanding a lateral pull of 1000 pounds, where shown on the Contract Drawings.

C. The base structures shall be placed on the bedding material to the lines and grades specified on the Contract Drawings. The Contractor shall take precautions to avoid cracking or causing other damage to the structure base or riser sections. Any damage done to the base or riser sections shall result in the structures being replaced at the Contractor's own expense.

D. Seal openings around pipe laterals with pipe penetration seals, and non-shrink grout. Protect clamp outside of manhole with minimum 2-inch wide (final applied width) heat shrink tape. Pipe penetration into the manhole shall be at least six (6) inches and no more than ten (10) inches beyond the inside wall of the catch basin at the spring lines of the pipe.

E. Attach mounting Frames and Covers in accordance with manufacturers' recommendations and as shown on the shop Drawings. Provide watertight seal between cover frame and concrete surface of manholes for sanitary and stormwater sewers.

3.3 INSTALLATION OF SEWER PIPES INTO EXISTING MANHOLES

A. Excavation and backfilling shall be as specified in Section 31 23 33.

B. The Contractor shall neatly core existing manholes in such a way as to not damage the structure and allow pipe installation. The core procedure shall be submitted to the Owner's Representative for review.

C. The existing manhole shall be repaired after installation of the new pipe. The manhole repair shall be made with non-shrink cement-based grout.

D. Repaired manholes shall not be backfilled until the concrete has achieved the specified strengths.

E. Pavement around the manhole shall be repaired as specified in Section 32 10 00 and as shown on the Contract Drawings.

END OF SECTION